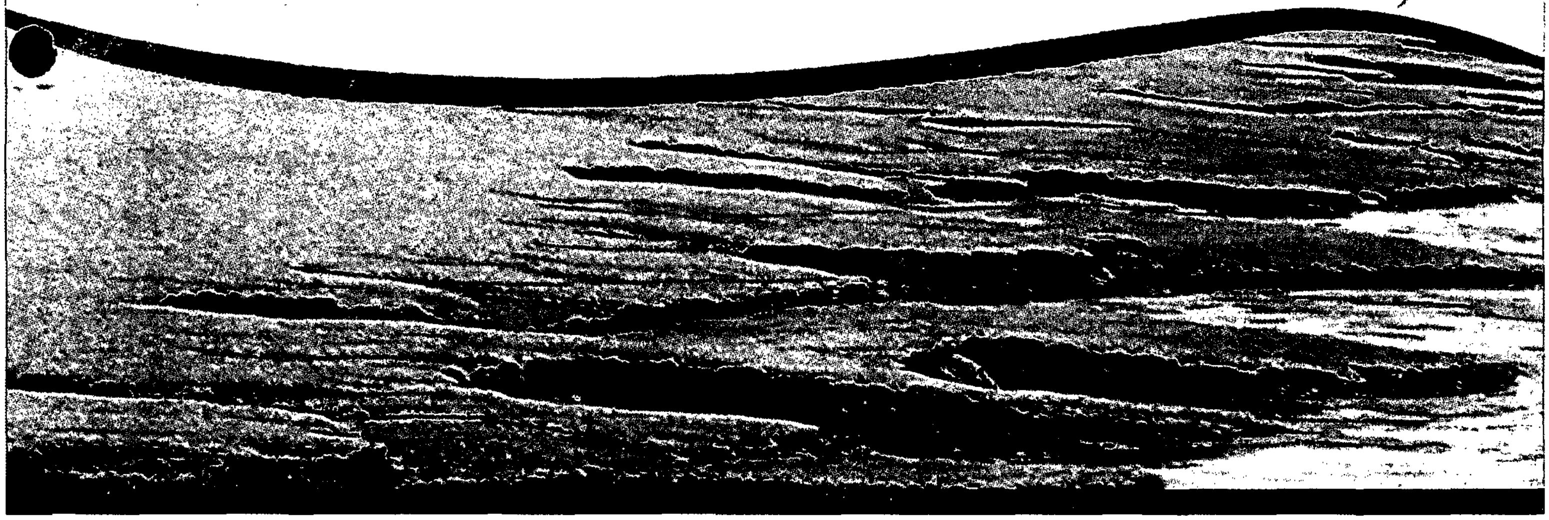
REPORT



# DRAFT SAMPLING AND ANALYSIS PLAN: SOIL STUDY, ADDENDUM 1
# SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

**Prepared for**

International Paper Company

U.S. Environmental Protection Agency, Region 6

**Prepared by**

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Anchor QEA | Anchor QEA, LLC |
| bgs | below ground surface |
| COI | chemical of interest |
| CSM | conceptual site model |
| dioxins and furans | polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans |
| DQO | Data Quality Objective |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| HASP | Health and Safety Plan |
| HRMS | high resolution mass spectrometry |
| I-10 | Interstate Highway 10 |
| Integral | Integral Consulting Inc. |
| IPC | International Paper Company |
| LiDAR | light detection and ranging |
| MIMC | McGinnes Industrial Maintenance Corporation |
| PRG | Preliminary Remediation Goal |
| QA | quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| REV | reference envelope value |
| RI | Remedial Investigation |
| SAP | Sampling and Analysis Plan |
| Site | San Jacinto River Waste Pits Superfund site |
| SJRWP | San Jacinto River Waste Pits |
| SOP | standard operating procedure |
| $TEQ_{DF}$ | toxicity equivalent calculated with dioxins and furans only |
| TOC | total organic carbon |
| UAO | Unilateral Administrative Order |
| UCL | upper confidence limit |
| USEPA | U.S. Environmental Protection Agency |

# 1 PROJECT MANAGEMENT

## 1.1 Distribution List

| Title | Name |
|---|---|
| USEPA Remedial Project Manager | Stephen Tzhone |
| USEPA QA Reviewer | Walter Helmick |
| Respondents' Project Coordinator and Anchor QEA Project Manager | David Keith |
| International Paper Co. Project Manager | Philip Slowiak |
| Integral Project Manager | Jennifer Sampson |
| Field Lead | Bill Lawrence |
| Laboratory QA Coordinator | Craig Hutchings |
| Database Administrator | Dreas Nielsen |
| Chemical Testing Laboratory Project Manager (Kelso) | Greg Salata |
| Chemical Testing Laboratory QA Manager (Kelso) | Julie Gish |
| Chemical Testing Laboratory Project Manager (Houston, HRMS analyses) | Darren Biles |
| Chemical Testing Laboratory QA Manager (Houston, HRMS analyses) | Andrew Biddle |

## 1.2 Introduction and Task Organization

This Addendum to the *Sampling and Analysis Plan: Soil Study* (Soil SAP) has been prepared on behalf of International Paper Company (IPC), pursuant to the requirements of Unilateral Administrative Order (UAO), Docket No. 06-03-10, which was issued by the U.S. Environmental Protection Agency (USEPA) to IPC and McGinnes Industrial Maintenance Corporation (MIMC) on November 20, 2009 (USEPA 2009a). The 2009 UAO directs IPC and MIMC to conduct a Remedial Investigation and Feasibility Study (RI/FS) for the San Jacinto River Waste Pits (SJRWP) Superfund Site in Harris County, Texas (the Site).

This document is an addendum to the Soil SAP. It addresses only the conditions, uncertainties, and investigation of soil to be conducted south of Interstate Highway 10 (I-10), and is submitted on behalf of IPC only. Each SAP for this Site consists of a Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP), included as Appendix A, and several attachments. This addendum references the Draft Soil SAP required by the 2009 UAO (Integral 2010) for all but selected sections of the main text and Appendix A, as described below. The Draft Soil SAP for this Site (Integral 2010) and this Addendum were prepared consistent with USEPA guidance and requirements for SAPs and QAPPs (USEPA 2001, 2002b),[1] as required by the 2009 UAO.

Soil sampling and analyses described in this addendum will be conducted in full conformance with the procedures and methods described in the Draft Soil SAP (Integral 2010). This addendum is intended to communicate details of the soil investigation to be conducted south of I-10 that differ from those of the investigation to be conducted north of I-10. The unique study components presented in this addendum include:

- Project Management (Sections 1.2 through 1.4, and 1.6 through 1.8)
  - Project Organization
  - Problem Definition and Background
  - Uncertainties and Data Gaps
  - Task Description
  - Data Quality Objectives
- Study Design and Methods (Section 2.1 and 2.2)
  - Sampling Design
  - Sampling Methods
- Field Sampling Plan (Appendix A)
  - Specific Sampling Methods Required for Soil Cores and Related Standard Operating Procedures (SOPs).

Those sections or subsections not named above are to be executed for this study as described in the Draft Soil SAP (Integral 2010). Therefore, this addendum and the Draft Soil SAP describe the means to achieve all quality assurance and quality control (QA/QC) requirements and documentation articulated by USEPA's guidance for preparation of QAPPs and FSPs (USEPA 2001, 2002b). USEPA's specifications, as described by Integral (2010), will be applied to the collection, analysis, QA review, data management, and reporting of the information generated as described in this addendum. Together, these components describe

[1] USEPA (2002b) is an update of the QAPP guidance cited in the 2009 UAO, which is USEPA (1998).

the soil study for the area south of I-10, which will be used to inform the RI/FS required by the 2009 UAO.

This section reviews the organizational structure for activities associated with the soil study south of I-10, including project management and oversight, fieldwork, sample analysis, and data management. The organizational structure for this project is illustrated in Figure 1. Contact information for key personnel is provided in Section 1.3.

## 1.3 Project Organization

IPC has retained Integral Consulting Inc. (Integral) and Anchor QEA, LLC (Anchor QEA) to perform the activities associated with execution of the Soil SAP Addendum. Figure 1 illustrates the organization of personnel on the project. The primary contacts for USEPA and IPC are provided in the following table. A description of the project organization and contacts pertaining to this QAPP are provided after the table.

**USEPA and Respondent Project Managers**

| Title | Name | Contact Information |
|---|---|---|
| USEPA Remedial Project Manager | Stephen Tzhone | U.S. Environmental Protection Agency, Region 6<br>1445 Ross Avenue<br>Dallas, TX 75202-2773<br>(214) 665-8409<br>tzhone.stephen@epa.gov |
| International Paper Company Project Manager | Philip Slowiak | 6400 Poplar Avenue<br>Memphis, TN 38197-0001<br>(901) 419-3845<br>philip.slowiak@ipaper.com |

To execute this study, Integral and Anchor QEA will conduct the fieldwork, database administration, coordination with the laboratories, and data analysis. The names and QA responsibilities of key project personnel who will be involved in sampling and analysis activities are provided below.

**Project Personnel Quality Assurance Responsibilities**

| Title | Responsibility | Name | Contact Information |
|---|---|---|---|
| Project Coordinator and Anchor QEA Project Manager | Coordination of project information and related communications on behalf of IPC with USEPA; liaison between USEPA project managers and respondent project managers | David Keith | Anchor QEA, LLC<br>614 Magnolia Avenue<br>Ocean Springs, MS 39564<br>(228) 818-9626<br>dkeith@anchorqea.com |
| Integral Project Manager | Responsible for the successful completion of tasks and coordination with the Anchor QEA project manager and the IPC project manager to execute the study described in this SAP | Jennifer Sampson | Integral Consulting Inc.<br>411 1st Avenue South<br>Suite 550<br>Seattle, WA 98104<br>(206) 957-0351<br>jsampson@integral-corp.com |
| | | Greg Salata | Columbia Analytical Laboratory Kelso<br>1317 S. 13th Avenue<br>Kelso, WA 98626<br>(360) 577-7222<br>gsalatata@caslab.com |
| | | Darren Biles | Columbia Analytical Laboratory Houston<br>19408 Park Row, Suite 320,<br>Houston, TX 77084<br>(713) 266-1599<br>dbiles@caslab.com |
| Anchor QEA and Integral Corporate Health and Safety Managers | Oversight of health and safety program for field tasks associated with RI/FS | David Templeton | Anchor QEA, LLC<br>1423 Third Avenue, Suite 300<br>Seattle, WA 98101<br>(206) 287-9130<br>dtempleton@anchorqea.com |
| | | Eron Dodak | Integral Consulting Inc.<br>319 SW Washington Street<br>Suite 1150<br>Portland, OR 97204<br>(503) 284-5545<br>edodak@integral-corp.com |
| Study Elements 1 and 2 Field Lead Integral | Field data collection and implementation of the Health and Safety Plan in the field | Bill Lawrence | Integral Consulting Inc.<br>411 1st Avenue South<br>Suite 550<br>Seattle, WA 98104<br>(206) 230-9600<br>blawrence@integral-corp.com |

| Title | Responsibility | Name | Contact Information |
|---|---|---|---|
| Study Elements 3 and 4 Field Lead Anchor QEA | Field data collection and implementation of the Health and Safety Plan in the field for Study Elements 3 and 4 | Chris Torell | Anchor QEA, LLC<br>290 Elwood Davis Road<br>Suite 340<br>Liverpool, NY 13088<br>(315) 453-9009 x17<br>ctorell@anchorqea.com |
| Project Database Administrator | Database development and data management | Dreas Nielsen | Integral Consulting Inc.<br>411 1st Avenue South<br>Suite 550<br>Seattle, WA 98104<br>(206) 957-0311<br>dnielsen@integral-corp.com |
| Laboratory QA Coordinator | Completeness of QA documentation and procedures; liaison between project personnel, chemical testing laboratories, and data validators and related QA communications with USEPA | Craig Hutchings | Integral Consulting Inc.<br>1205 West Bay Dr. NW<br>Olympia, WA 98502<br>(360) 705-3534<br>chutchings@integral-corp.com |
| Laboratory QA Manager | Ensure quality of data; oversee laboratory QA and QC practices, records, and procedures; address nonconformity and corrective actions and reports; and coordinate efforts with laboratory project manager | Julie Gish | Columbia Analytical Laboratory Kelso<br>1317 S. 13th Avenue<br>Kelso, WA 98626<br>(360) 577-7222<br>jgish@caslab.com |
| | | Andrew Biddle | Columbia Analytical Laboratory Houston<br>19408 Park Row, Suite 320,<br>Houston, TX 77084<br>(713) 266-1599<br>abiddle@caslab.com |

The responsibilities of the project manager and QA manager at the analytical laboratories used for this task are described in the Soil SAP.

## 1.4 Problem Definition and Background

On March 19, 2008, USEPA added the Site to the National Priorities List, and the 2009 UAO requires that an RI be conducted at the Site. The investigation described in this Addendum will address uncertainties about the following aspects of the Site as they relate to the potential soil contamination in the area south of I-10 (Area 4):

- The nature and extent of Site-related soil contamination
- The exposure of human and ecological receptors that may be using the Site and may have direct or indirect contact with contaminated soil
- The physical characteristics of the Site and physical processes governing fate and transport of Site-related contaminated soil.

Relevant background information on the Site, including the Site history and a conceptual site model (CSM) for the area of investigation north of I-10, can be found in Anchor QEA and Integral (2010). The CSM and Site history presented by Anchor QEA and Integral (2010) do not address historical waste disposal practices in areas south of I-10, or any related releases of hazardous substances, contaminant transport, or exposure pathways. USEPA is requiring that the Remedial Investigation include areas south of I-10 and IPC (but not MIMC) has agreed to perform the investigation in that area. The Draft Soil SAP (Integral 2010) describes four soil collection areas and collection of background soils. This Addendum addresses the investigation to be performed in Area 4 only.

### 1.4.1 Site Description

The Site consists of impoundments, built in the mid-1960s for disposal of paper mill wastes, and the surrounding areas containing sediments and soils potentially contaminated with the waste materials that had been disposed of in these impoundments. Two impoundments, together approximately 14 acres in size, are located on a 20-acre parcel immediately north of the I-10 Bridge and on the western bank of the San Jacinto River, in Harris County, Texas (Figure 2).

Based on historical documents and aerial photographs, USEPA has identified an area south of I-10 to be investigated for soil contamination. USEPA's review indicates that an additional impoundment was constructed south of I-10, on the peninsula of land directly south of the 20 acre parcel, and also was used as a disposal area in the mid-1960s for paper mill waste similar to that disposed of in the two impoundments north of I-10. A Texas State Department of Health inspection report dated May 6, 1966 describes a pond south of the highway in a drawing, and states that it is approximately 15 to 20 acres in size (TSDH 1966). Figure 2 shows both the 1966 perimeter of the impoundments north of I-10, and the potential area of investigation of soils south of I-10. A discussion of the perimeter of the impoundment south of I-10 and related uncertainties is presented below.

USEPA has not identified any evidence of releases or threatened releases of hazardous substances from the south impoundment. Sediment samples were taken in the Old River area south of I-10, adjacent to and to the west of the south impoundment, as part of the April 2010 approved *Sampling and Analysis Plan: Sediment Study San Jacinto River Waste Pits Superfund Site* (Integral and Anchor QEA 2010). Results from the sediment sampling indicate that sediments from the three stations directly adjacent to the southern impoundment area are not contaminated with polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (dioxins and furans) at levels greater than those found in sediment from the upstream background area sampled at the same time. In a fourth sample further downstream, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin was not detected in sediment, and the toxicity equivalent ($TEQ_{DF}$) concentration was also within the range of upstream background. These data suggest that dioxins and furans have not been released from the south impoundment to the adjacent aquatic environment. A number of uncertainties remain, and will be addressed by the soil sampling program described in this SAP Addendum.

#### 1.4.1.1 Impoundment Location and Configuration

Multiple aerial images of this area of the Site have been analyzed to determine the location and history of the impoundment south of I-10. These images, from 1962, 1964, 1966, 1970, and 1973, are presented in Appendix B along with key historical documents (TSDH 1966; McGinnes 1966). Review of the aerial photograph from 1964 indicates that an impoundment south of I-10 was constructed by forming berms adjacent to the shoreline of the peninsula south of I-10 separating the main channel of the San Jacinto River and the Old River (Appendix B). This is consistent with the impoundments north of I-10, which were constructed in 1965 by forming berms within the estuarine marsh (Anchor QEA and Integral 2010). In addition, USEPA has provided an interpretation of the aerial photograph from 1964 showing a possible perimeter of the south impoundment (13.4 acres), as well as an interpretation of an historical drawing included in the TSDH (1966) inspection report dated

May 6, 1966 (22.8 acres). The larger of these two perimeters was used to define the area of the soil investigation (Figure 2).

Both of these possible impoundment perimeters are shown in Figure 3. An alternative interpretation of the TSDH (1966) drawing (20.9 acres) is also shown in Figure 3. This alternative interpretation is based on the appearance of roads on aerial photographs from 1964 and 1973 that suggest a somewhat different shape than that proposed by USEPA. Finally, an aerial photograph from October 16, 1966 (Appendix B) shows an area south of I-10 that appears to be covered by liquid; this fourth possible perimeter (7.9 acres) is also shown in Figure 3. A drawing included in a July 21, 1966, document (McGinnes 1966) seeking a permit from the state to drain the liquid contents of the southern impoundment into the Old River, west of the peninsula of land south of I-10, depicts an area that is similar in shape and location to the wetted area shown in the 1966 aerial photograph.

#### *1.4.1.2 Waste Disposal and Waste Characteristics*

In 1965 and 1966, pulp and paper mill wastes (both solid and liquid) were reportedly transported by barge from the Champion Paper Inc. paper mill in Pasadena, Texas, and unloaded at the Site into the impoundments, where the waste was stabilized and disposed (TSDH 1966). The excess water from the impoundments was pumped back into barges and taken off the Site. The Champion Paper mill used chlorine as a bleaching agent, and the wastes that were deposited in the impoundments north of I-10 have been found to be contaminated with dioxins and furans and some metals (TCEQ and USEPA 2006); additional discussion of the chemical constituents typical of materials like those deposited in the impoundments is provided in Section 1.5 of the Sediment SAP for this Site (Integral and Anchor QEA 2010) and in Appendix C of the RI/FS Work Plan (Anchor QEA and Integral 2010). The impoundments north of I-10 were used for waste disposal from September 1965 through late 1966.

Currently available information about the area south of I-10 is not very detailed but indicates that wastes deposited in the south impoundment may also have originated from the Champion Papers Inc. paper mill, and that the impoundment was used for "stabilization" of liquid wastes (McGinnes 1966). "Stabilized waste water and rain water" are the subject of the

McGinnes (1966) permit request. Stabilization may have involved allowing solid waste materials to settle from liquid effluent prior to removal or draining of liquids off the top of the pond. The quantity and spatial distribution of any solid wastes that may remain in the area south of I-10 are unknown.

### *1.4.1.3 Changes Over Time*

Physical changes at the Site in the 1970s and 1980s, including regional subsidence of land in the area due to large scale groundwater extraction, and sand mining within the river and marsh to the west of the impoundments north of I-10, have resulted in partial submergence of the impoundments north of I-10 and exposure of the contents of these impoundments to surface waters. Historical aerial photography does not indicate that any part of the land south of I-10, or any southern impoundment, has been submerged as a result of subsidence.

To determine the temporal evolution of the impoundment south of I-10, aerial photographs of this area from 1962 through 1973 were examined (Appendix B). Analysis of these photographs results in the following observations:

- **No impoundment existed in 1962.** The aerial photograph from 1962 indicates the absence of any impoundments at that time.
- **The perimeter berms of the southern impoundment never formed a complete enclosure.** The photograph from 1964 shows constructed berms adjacent to the western shoreline of the peninsula south of I-10. There is no berm visible along the southern or southeastern edges of this area in 1964. The eastern berm is shorter than the western berm, extending only about half the length of the western berm, and apparently trending southeastward for a short distance at its southern extent, ending in the middle of the peninsula. Photographs in subsequent years do not show southern or southeastern berms.
- **The topography in 1964 can be discerned.** On the basis of apparent liquid pooling around the edges of the impoundment in 1964, it appears that the interior of the impoundment was elevated above the edges that parallel the berms. This configuration is consistent with a construction process involving excavation of soils and use of the sidecast to create the berms directly adjacent to the excavated area. In this type of process, the excavated area directly adjacent to the berms is deepest, and

the area in the middle is undisturbed and remains at a somewhat higher elevation. Because excavation would have lowered the elevation of the excavated area (directly adjacent to the newly formed berms), there is what appears to be liquid visible in 1964, which could be stormwater, water upwelling from the shallow groundwater environment, or wastewater that was deposited there. The interior section of the impoundment also has significant vegetation cover in 1964.

- **Vegetation within the 1964 impoundment resembles vegetation outside of it, and resembles vegetation in 1962.** In the 1964 aerial photograph, the vegetative conditions within the berms are the same as those to the east of the eastern berm. The vegetative patterns in the 1962 aerial photograph, prior to any apparent berm construction, are the very similar to those in 1964. If the entire area defined by the larger of USEPA's two estimated perimeters (Figure 3) had been flooded by liquid waste between 1962 and 1964, vegetative impacts would be observable as changes between 1962 and 1964, but no changes are apparent.
- **There is no indication that an eastern berm existed at the location of the eastern edge of the larger of USEPA's two estimated impoundment perimeters (Figure 3).** Comparisons between the 1962 and 1964 aerial images reveal that the same bright linear feature existed in both images along the eastern edge of the larger of USEPA's two estimated impoundment perimeters. This feature is most likely a roadway rather than a berm primarily because its existence predates (1962, Figure B–1) any impoundment construction (1964, Figure B-2) in this area. It is shown as a road on a 1967 U.S. Geological Survey topographic map (see Figure 2-21 of the RI/FS Work Plan). This road appears to be the only access way to a structure near the eastern shore of the peninsula, which is visible in the same location in the aerial images starting in 1962 through 1970 (Appendix B). Moreover, if this structure were a berm, its construction would have resulted in the digging of a parallel trench, as evidenced by the berm-trench feature visible in the 1964 aerial image (Figure B-2) along the western edge of the impoundment. No such trench, depression or accumulation of water appears alongside this roadway in any of the aerial images 1962-1973 (Appendix B).
- **The flooded area visible in the aerial photograph from 1966 is consistent with a drawing of the southern impoundment by McGinnes (1966).** Available aerial photographs are consistent with the July 21, 1966, permit request by McGinnes

(1966) in two important ways: the timing of liquids being present in the south impoundment (middle of 1966) and the shape of the ponded area. An aerial photograph from October 16, 1966, shows an area south of I-10 apparently covered by liquid, roughly corresponding in length to the length in the north–south direction of the eastern berm visible on the 1964 image. The McGinnes (1966) permit request shows a drawing of the pond that is the subject of the request that appears as a simple rectangular shape with rounded corners. This drawing strongly resembles both the shape and location of the pond shown in the 1966 photograph, although the photograph shows the southern and southeastern perimeters of the ponded area as irregular, while the drawing shows a regular rectangular shape throughout.

- **The topography of the impoundment in 1964 is very similar to the topography in 1973.** Available aerial photographs suggest that the impoundment south of I-10 was not filled to capacity with solid waste and may have contained only limited amounts of contaminated solids. Evidence to support this interpretation is in the aerial images from 1970 and 1973. An aerial photograph from 1970 shows ponding in the same area that shows ponding in 1964, indicating that the topography within that impoundment was the same in 1970 as it was in 1964. The 1973 aerial photograph shows a depression in the northern end of the perimeter traced from the 1964 photograph by USEPA that strongly resembles the 1964 condition in the same area. Given that the disposal of paper mill wastes at the Site ended in the 1960s, consistencies in topography between 1964 and 1970 and 1973 strongly suggest that solid waste deposits in the impoundment south of I-10 are likely limited in volume. These analyses and the comparison of the 1964 and 1973 aerial images (Appendix B) also suggest that the impoundment south of I-10 remained contained within the berms of the original 1964 construction throughout its history, and therefore that the lateral and vertical extent of any solid wastes deposited in the area during the 1960s is likely limited to the U-shaped wetted area visible in the 1964 aerial photograph.

More recent data, including several aerial photographs since 1973 and the 2008 light detection and ranging (LiDAR) data (HGAC 2008) show that the site of the impoundment south of I-10 is currently a mixed-use commercial environment (Appendix B). Comparison of the 1964 perimeter with recent topographical information shows that the original 1964 berms are no longer present and that the area once used for waste disposal has been graded into parking lots and building sites (Figure B7). Beginning in the 1970s, much of the peninsula south of I-10 underwent substantial physical change due to road development, filling and excavation along the western shoreline and building development. In the 2008 LiDAR topographic imagery (Appendix B), a relatively elevated feature or mound is apparent at the northern extremity of the historical (1966) wetted perimeter (Figure B7). Its shape does not resemble the original perimeter berm, and it is not in the same location as the original perimeter. Grading for building construction and parking lots within this area may have resulted in the creation of this mound. In this context, there is a potential that historical material deposited within the impoundment or soils contaminated by liquid wastes were disturbed during grading and construction and that contamination may occur within this mound.

#### *1.4.1.4 Surrounding Land Uses*

Freshwater, estuarine, and marine habitats occur in the vicinity of the Site. Residential, commercial, industrial, and other land use activities occur within the preliminary Site perimeter and in the surrounding area. Residential development on the eastern bank of the river is present within 0.5 mile of the Site. The area once occupied by the impoundment south of I-10 is currently under industrial or commercial use, including use by a towing company, a shipbuilding company, and a shipyard. A sandy intertidal zone is present along the shoreline throughout much of the Site (Figure 2).

## 1.5 Summary of Available Soils Data

There are no data to describe surface or subsurface soil quality available for the area south of I-10. Site and background soils data relevant to the RI are described in Section 1.4.2 of the Draft Soil SAP for this Site (Integral 2010).

## 1.6 Conceptual Site Model and Problem Definition

This Addendum to the Soil SAP specifically addresses potential transport and exposure pathways for the impoundment south of I-10. The overall CSM (Figure 4), and exposure CSMs for human and ecological receptors relating to the impoundments south of I-10, are illustrated in Figures 5 and 6, and discussed below.

An impoundment was constructed south of I-10 between 1962 and 1964 and received pulp mill wastes in the mid-1960s. The potentially affected soil is the subject of the investigation in Area 4. Major physical changes in the area since the impoundment was constructed include land subsidence due to groundwater withdrawal in the 1960s and 1970s, as well as industrial and commercial activities involving shipping, track and road development, building construction, shoreline filling and excavation, and soil grading. Historical aerial photography suggests that the area affected by the waste impoundment is likely limited to an area that appears to have been flooded in 1966. The impoundment south of I-10 was not exposed to surface waters as a result of subsidence, and sediments to the west of the impoundments are not contaminated with dioxins and furans to levels above background, indicating that contamination from the former impoundment has not been released to the aquatic environment. Extensive tracking across the area could have mixed surface contamination, and grading of soils to build today's parking lots could have mixed historical waste deposits into surface soils, particularly at the northwest end of the peninsula south of I-10.

Contact with potentially contaminated soil in the area south of I-10 creates the possibility for exposure of ecological receptors and people using the Site to chemicals of interest (COIs). Ecological receptors and people using Area 4 of the Site also may be exposed to COIs from global, regional, and local sources that are unrelated to the paper mill waste deposited on the Site. Because the area along the perimeter of the impoundment south of I-10 has been the location of various industrial, shipping, and other commercial activities since the 1960s, people working in the area south of I-10 may be exposed to COIs in soil that are present, but not as a result of the disposal of paper mill wastes in the 1960s. Area 4 is occupied by active industrial and commercial properties, many of which are fenced and gated. For this reason, potential exposure to contaminated soil in Area 4 may be limited for people and ecological receptors. The low concentrations of dioxins and furans in sediments adjacent to and downstream of the south impoundment indicate limited potential for transport of surface soils or soil contaminants from this area into the aquatic environment. Thus, current information suggests that processes of release of hazardous substances, transport mechanisms, and pathways leading to exposure likely do not include significant pathways to the aquatic and sediment environments, and that paper mill waste related contamination of soil in the area south of I-10 is limited to Area 4. Moreover, given that the volume of waste deposited in the area may be very low, the importance of the transfer of COIs to groundwater as a transport pathway is unknown. The results of the evaluation of historical information and recent sediment data can be summarized in the overall CSM for the impoundment south of I-10, presented in Figure 4.

The overarching issue to be addressed by the study described in this Addendum is whether COIs associated with paper mill wastes generated in the 1960s occur in the surface and subsurface soils of Area 4 and, if so, the nature and extent of their distribution in affected soils. Resulting data will be used to evaluate both the nature and extent of contamination, and exposures and risks to ecological and human receptors. Both the exposure and risk assessment, and characterization of background conditions in soil will inform the development of Preliminary Remediation Goals (PRGs), if evaluation of remedial actions for soils is determined to be necessary. Where groundwater wells may be installed for evaluation of groundwater quality beneath Area 4 (draft Groundwater SAP and SAP Addendum; Anchor QEA 2010a,b), the chemistry, grain size, and lithology of soils from the well cores may be needed to facilitate interpretation of groundwater data.

## 1.7 Uncertainties and Data Gaps

Uncertainties and data gaps for soils on the Site south of I-10 are discussed below. The soil study proposed in this document addresses the collection and analysis of new information to address the uncertainties concerning the nature and extent of contamination, exposure potential, and risks due to contamination of soils associated with the southern impoundment, and potential for ongoing or post-remediation recontamination of sediment as a result of surface transport of contaminated soil to the aquatic environment.

### *1.7.1 Nature and Extent*

There are currently no data to describe the chemistry of soils on the Site south of I-10. There is a gap in the soil data for appropriate characterization of the nature and extent of contamination in the upland areas south of I-10 that may have been affected by waste-associated COIs. This data gap will be addressed by a sampling design to define the location of any buried waste, and to address the vertical and lateral extent of related surface and subsurface contamination. The nature and extent evaluation is informed by the current understanding of the site physical conceptual model and by Site history.

The Site history suggests that concentrated waste materials, if present, are more likely to be within the area shown as excavated in the1964 aerial photograph than elsewhere on the peninsula south of I-10. The specific location and vertical distribution of concentrated waste material is the most significant data gap. The degree to which any buried waste deposits, or soils contaminated by the presence of liquid wastes, are present at the surface is also a data gap. Finally, the relative importance of the paper mill waste as a source of COIs to soils south of I-10 is unknown. However, if the area most likely to contain concentrated wastes does not show significant contamination, and surface soils in this area do not show evidence of contamination by paper mill wastes, then the absence of information on soil chemistry elsewhere on the peninsula south of I-10 is not a data gap. Therefore, the area of the investigation is divided into Areas 4a and 4b (Figure 7), and the investigation will be conducted in two phases, described further below. Phase I will address data gaps related to nature and extent for Area 4a and will determine if Phase II is needed. If so, uncertainties and data gaps for Area 4b will be determined in consultation with USEPA. Additional information to describe this process is provided in Sections 1.8 and 1.9.

Ancillary information required to interpret soil chemistry data (e.g., in comparisons between samples or between areas) include the total organic carbon (TOC) content of soils and the grain size distribution.

### *1.7.2 Human and Ecological Exposures*

Human and ecological receptors may be exposed to contaminated soils in upland areas. Four types of human receptors have been identified in the RI/FS Work Plan (Anchor QEA and Integral 2010) for the baseline human health risk assessment: subsistence fisher, recreational fisher, trespasser, and recreational user. The area south of I-10 is developed and managed for commercial and industrial activity, and therefore industrial workers have potentially complete and significant soil exposure pathways via direct contact, which includes incidental ingestion and dermal contact. Trespassers may also be exposed to COIs in soil south of I-10. The ecological exposure CSM indicates that there are no complete exposure pathways to soil for benthic invertebrates and fish. Ingestion of soils and biota that have been exposed to soils is a complete and significant pathway for reptiles, birds, and mammals, and direct dermal contact and inhalation exposure to these receptors are considered potentially complete but minor. Because there are currently no data to describe COIs in soils on the Site, information required to evaluate baseline exposures of workers coming into contact with soils in the upland area south of I-10 potentially affected by the impoundments is needed. Information is also required to evaluate baseline exposures of ecological receptors coming into contact with surface and shallow subsurface contaminated soils.

As for the nature and extent evaluation, characterization of soil-related exposures to COIs potentially attributable to the waste stored in the impoundments requires information on the soil-related exposures of COIs from background areas. Information on COIs in background soil from off-Site areas (Integral 2010) is also considered a data gap.

### 1.7.3 Physical CSM and Fate and Transport Evaluation

Because upland soils may have surface contamination, processes of erosion could transfer COI-contaminated soils back into the aquatic environment, potentially contaminating surface water and sediments adjacent to the uplands. For the evaluation of remedial alternatives, information on the potential transfer pathways for COIs from uplands to the aquatic environment is needed. Concentrations of COIs in soils, and the physical transfer pathways for potentially contaminated soils to the aquatic environment will be required to characterize the extent of potential transfer of COIs via erosion, and the spatial distribution of areas where soil deposition could affect sediment quality. Therefore, in addition to data gaps for COIs in soils in the upland areas south of I-10, the specific hydrologic pathways that could facilitate the transfer of soils into the aquatic environment via surface runoff are unknown. Information on potential surface transport pathways based on the topography of Area 4 is a data gap.

An additional data gap relating to this study element is data for the physical characteristics and chemistry of soils within cores of groundwater monitoring well pairs that may be installed to evaluate the chemistry of groundwater. A groundwater SAP addendum that describes a groundwater sampling program to determine whether COIs from the Site are present in groundwater underneath the impoundments south of I-10 will be developed if extensive subsurface soil contamination is identified by this study. Soil lithology, grain size distribution, and chemistry data from the locations where the wells would be drilled may be needed to interpret the groundwater data.

### 1.7.4 Engineering Design Evaluation

Until the nature and extent, potential for exposure, and potential for surface transport are better characterized, data gaps relating to engineering design cannot be defined. Any need for additional soil data relating to an engineering design evaluation will be addressed in an addendum to the Soil SAP.

## 1.8 Task Description

The soil study will address data gaps by generating new data for soil chemistry for Area 4 of the Site, which is south of I-10. The soil study will be conducted in two phases:

- **Phase I**. The Phase I soil investigation is described in this Addendum and has three objectives:
  - Identify the specific location of historically deposited paper mill waste material
  - Develop sufficient information to characterize exposure of human and ecological receptors to soil-related contamination
  - Provide information necessary to determine whether Phase II is necessary.
- **Phase II.** Performance of the Phase II investigation will depend on the outcomes of Phase I. If Phase I does not identify areas of significant surface or subsurface contamination of soils with paper mill wastes, Phase II will not be conducted (decision points are specified in Section 1.9). If significant paper mill waste-related contamination is identified, IPC will meet with USEPA to discuss the results and determine whether Phase II is necessary, and will work in consultation with USEPA to define uncertainties and data gaps to be addressed. If necessary, Phase II will likely include additional sampling across Area 4b for nature and extent and exposure assessments, and may also include groundwater sampling.

Within this framework, the soil study to be conducted south of I-10 consists of a series of tasks, to be executed by Integral and Anchor QEA on behalf of IPC and in consultation with USEPA:

- Agreement on the Phase I study design and finalization of a complete Soil SAP for the Site and a Soil SAP Addendum that addresses the area south of I-10
- Success in gaining access to private properties affected by the study design
- Fieldwork to collect the required soil samples, and appropriate execution of contingency plans as needed for conditions in the field
- Effective communication of modifications to the SAP during sampling, development of a consensus view of the means to address required changes, and employment of contingencies and alternatives identified during the field sampling
- Effective processing, handling, shipment, and analyses of soil samples, all of which conform to specifications of the Draft Soil SAP and this SAP Addendum
- Complete documentation of sample collection, deviations from the SAP, field activities and observations, sample processing and shipping, chain of custody requirements, and analytical procedures
- Validation of soil chemistry and conventionals (organic carbon and grain size) data according to specifications in this SAP
- Complete and timely loading of validated data into the project database, and dissemination of the data to USEPA and interested parties.
- Analysis and discussion of Phase I results with USEPA, and identification of uncertainties and data gaps and appropriate objectives for Phase II, if necessary.

The soil study will address data gaps by generating new information relating to three of the four study elements that have been defined for the RI/FS (Anchor QEA and Integral 2010):

- Study Element 1: Nature and Extent Evaluation. Data will be used to locate buried soils with significant contamination by paper mill wastes, if any, and to characterize the nature and extent of COIs south of I-10 in soils potentially affected by waste handling in areas south of I-10.
- Study Element 2: Exposure Evaluation. Data will be used to evaluate the potential ecological and human exposures and related health risks resulting from contamination of soils potentially affected by paper mill waste handling in areas south of I-10.

- Study Element 3: Fate and Transport Evaluation. Topographic data will be used to identify physical transport pathways and to evaluate the potential for transport of COIs in soil to the aquatic environment. Soil chemistry, lithology, and grain size data may be needed to evaluate the potential for transport of COIs in soil to groundwater within the Site, if a groundwater study is needed.

Completion of Study Elements 1 through 3 (as described in this document) will allow determination of whether significant contamination is present, evaluation of the nature and extent of contamination of soils with COIs, determination of whether COIs in soils are associated with unacceptable risks to human and ecological receptors, and determination of whether COIs may be transferred from the uplands areas to the aquatic environment. After these evaluations are complete, a decision will be made to determine if additional data gaps and uncertainties remain for Area 4b. Following completion of the soil study, a decision will be made to determine whether remediation of soils is required, and if so, whether soil data generated by this study are sufficient to support design of remedial actions. If additional sampling is required, then additional Soil SAP addenda will be prepared to describe the approach and requirements of Study Element 4: Engineering Construction Evaluation.

Data Quality Objectives (DQOs) for each element as they pertain to the impoundments south of I-10 and related soil contamination are discussed in Section 1.9. The study design is described in greater detail in Section 2.1. Analytes for all soil samples for the exposure evaluation include COIs (Table 1).

Sampling of soil for Phase I will take place in the winter of 2010–2011 (Anchor QEA and Integral 2010), unless other arrangements regarding the sampling period are made in consultation with USEPA.

## 1.9 Data Quality Objectives

This section presents a summary of the DQOs for soil sampling south of I-10 to evaluate nature and extent, human health and ecological exposure, and the potential physical transport pathways of soils to the aquatic environment or to groundwater. DQO discussions for Study Elements 1 and 2 are combined because the sampling objectives and analysis plans for these two study elements are integrated for soils. These DQOs have been prepared consistent with USEPA (2006) guidance. Establishing DQOs assures that data generation and sampling will be focused on the goals of the RI/FS and will be sufficient to address those goals. The DQO summaries in the following subsections include, for each study element, a statement of the problem, components of the sampling design necessary to support the analytical or interpretive approach, and a description of the analytical approach to be followed.

### 1.9.1 DQOs for Study Elements 1 and 2: Nature and Extent Evaluation and Exposure Assessment

The RI/FS is being undertaken to address contamination of sediments and soil within and in the vicinity of the impoundments at the Site (Figure 2) and to address contamination of other environmental media that have been in contact with contaminated media at the Site. Soils at the location of the impoundment south of I-10, or where paper mill waste was handled in that area, may be contaminated with COIs. To effectively plan for any remedial actions that might be required, the spatial and vertical extent of soil contamination will be evaluated, at least in part, by comparison of soil data to the appropriate reference envelope value (REV), and to concentration-based PRGs for soils.

The RI/FS will address exposures of human and ecological receptors associated with contamination of Site soil that may have resulted from activities in the impoundments south of I-10 related to disposal or handling of paper mill waste, and risks associated with soil contamination within this area. The exposure evaluation and risk assessment will support planning for Phase II soil investigation, and for remedial actions, if needed. To do so, the degree of contamination of surface soils relative to appropriate risk-based screening levels will be evaluated. This section presents the technical rationale and general approach for conducting the evaluation of human and ecological exposures to COIs in soil from Area 4a of the Site.

#### *1.9.1.1 Statement of the Problem*

Problems relating to characterization of the nature and extent of contamination, and to the exposure assessment, will be addressed by this study.

#### 1.9.1.1.1 Nature and Extent

The primary problem to be addressed by Study Element 1 of the RI/FS (the nature and extent investigation) is uncertainty in the spatial and vertical extent of contamination in soils in the area of the soil investigation south of I-10, and the specific location of buried waste, if any, within Area 4a. A related problem to be addressed by Study Element 1 is the comparison of COI concentrations in Site soils with concentrations in soils from background areas to evaluate the relative contribution of wastes from the impoundments to any COIs identified in soil. The nature and extent evaluation, including characterization of soils in background areas, will address these problems and thereby facilitate the determination of whether a Phase II investigation is needed south of I-10, and if so, what uncertainties should be addressed. The overall investigation of Area 4 will facilitate selection and implementation of remedial approaches, if required.

Evaluation of the importance of Site-related COIs in Area 4 soils relative to atmospheric, global, and other sources requires characterization of contaminated soils using dioxin and furan signatures. Upland areas off-site, potentially subject to the same types of regional and atmospheric influences as soils at the Site (e.g., traffic on freeways), are relevant for assessing soil conditions and soil chemistry that could occur as a result of processes other than those that may have transferred materials from the impoundment to the surrounding soils. Although some soils data for urban, residential, forested, grassy, and transitional areas in the Houston area have been previously collected (Table 1 of Soil SAP), a larger number of samples is required for quantitative comparison (Gonzales 2007). Because of the potential influence of traffic on rates of atmospheric deposition of dioxins and furans (University of Houston and Parsons 2006), and the proximity of the upland areas of the Site to I-10, background areas selected for collection of soils and comparison to the Site soils should be similar to this Site in terms of proximity to traffic. Samples from background areas that are as close to the freeway as the Site is will be collected to ensure that the influence of background sources on Site soils is characterized. Background sampling for this DQO is described in the Draft Soil SAP (Integral 2010). Analytes for background samples will include all COIs for the purposes of this SAP Addendum.

Because Area 4 is adjacent to properties with ongoing industrial activities, and which have a history of industrial activity, soils in Area 4 may be contaminated with COIs from sources unrelated to disposal of paper mill waste in the 1960s. A problem to be addressed by this study is that both the nature and extent of contamination with COIs and the potential exposures of human and ecological receptors to COIs may be affected by sources unrelated to waste that may have been disposed in the impoundment. Background areas selected for the soil investigation (Integral 2010) may not provide relevant information for evaluating the role of neighboring industries that occur on the Site. Information on vertical chemistry profiles will be used to distinguish between COIs present as a result of paper mill waste disposal and those COIs present as a result of other industrial activities on the Site.

#### 1.9.1.1.2 Exposure Assessment

People working on the peninsula south of I-10 may be exposed to COIs in soil via direct contact (ingestion and dermal) with soils that may have been affected by handling of wastes or contaminated soil in the area south of I-10 (Figure 3). Characterization of risk in support of selection and implementation of remedial approaches requires information on contamination in soils accessible to people. One problem to be addressed by the soil study is uncertainty and data gaps regarding concentrations of COIs present in soil directly contacted by people working on this portion of the Site.

A related problem is the potential for ecological receptors at the Site to be exposed through direct ingestion of contaminated soil, or ingestion of biota that have been exposed to contaminated soil. The problem to be addressed in the ecological exposure evaluation is uncertainty regarding the magnitude and spatial extent of exposures of birds, mammals, and reptiles to contaminants in Site soils.

For both human and ecological receptors, there is additional uncertainty regarding the exposures to COIs in soils of background areas. Information on exposures and risks to human and ecological receptors both at the Site and in background areas are needed in the evaluation of remedial options.

#### 1.9.1.2 Sample Collection Design

The soil sampling design for Study Elements 1 and 2 was developed in consideration of the following:

- Soil collection described by this Addendum addresses Area 4a only. The need for new data was determined on the basis of the extent to which Area 4a could have been affected by handling of liquid and solid paper mill wastes, and by uncertainties as to the degree and location of significant sources of soil contamination originating with the disposal of paper mill wastes in the 1960s.
- Spatial distribution of sampling stations.
- Potential depth of COI contamination.
- Depth at which human and ecological receptors may contact soil.
- Total sample numbers necessary for exposure assessment.
- Characterization of background in off-site areas that are generally equivalent to the Site in terms of non-Site influences

**Soil Collection Areas**

To evaluate the nature and extent of contamination, the overall Site has been divided into four areas (Draft Soil SAP; Integral 2010). Area 4 is the area of soil investigation that is south of I-10. Area 4 has been divided into two subareas based on the analysis of historical aerial photographs (Section 1.4): Area 4a and Area 4b. Area 4a is defined by the perimeter of the area that is flooded in the 1966 aerial image, and is considered to be the area most likely to be contaminated as a result of paper mill waste disposal in the 1960s. The area outside this perimeter and bound by the larger of the two hand drawings provided by USEPA has been defined as Area 4b. Background areas are those defined as such in the Draft Soil SAP (Integral 2010).

**Spatial Distribution of Samples in Area 4a**

Because the most significant uncertainty is the specific location of any buried paper mill waste, and because there is no soil chemistry data for the area south of I-10, a biased sampling design targeting the likely areas of contamination will be used. To characterize the nature and extent of contamination in soils south of I-10, soil core stations are located to correspond to the most likely location of subsurface and surface contamination (Figure 9).

Soil boring locations were targeted based on our current understanding of the site history and CSM (Section 1.4) and are placed to maximize the likelihood that the location and extent of any contaminated materials that may be buried will be identified. All soil cores will have a vertical resolution of 2 feet, with the top 2-foot increment subdivided into 0–6 inch, 6–12 inch, and 12–24 inch increments The rationale for the placement of these soil cores is detailed below:

- Four soil cores are targeted in the area likely to have had the lowest elevation in the mid 1960s, and which therefore would contain any solid waste deposits that exist.
- Two cores are located on a north–south transect along the centerline of the impoundment, with both intended to identify any waste deposits that may occur within the middle of the impoundment
- One core location is on the soil mound visible in the 2008 LiDAR data (Figure B-7 in Appendix B).

All seven cores will have a vertical resolution of 2 feet, but will also provide information for surface and shallow subsurface soils for use in exposure evaluation. Analytical results will describe the lateral and vertical extent of contamination within Area 4a.

To generate information sufficient for addressing human and ecological exposures, samples of surface and near surface soil will be collected from an additional four locations within Area 4a, and placed in between cores. Locations were selected by visually estimating the distribution needed to provide reasonable spatial coverage of Area 4a.

**Sample Depth and Analytes**

For consistency with the design described in the Draft Soil SAP (Integral 2010) and the background samples, the design includes the following sample types:

- Surface and subsurface soil samples will be collected from four stations at two depths, 0–6 inches
  (0–15 cm) and 6–12 inches (15–30 cm).
- Cores for nature and extent characterization to be collected to a maximum depth of 14 feet at seven stations throughout Area 4a, and with 2-foot intervals (as described above).

- The topmost 2-foot interval in the cores in Area 4a will be divided as follows: 0–6 inches (0–15 cm), 6–12 inches (15–30 cm), and 12–24 inches (0–60 cm).

Core and surface samples will be analyzed for COIs, TOC, and grain size.

At all sample locations on the Site, and for all depth intervals, an additional 16 ounces of soil will be collected and archived. For the core locations, more than one soil boring may be required to collect sufficient mass. Should this be the case, additional boring locations will be placed within 1 foot of each other as needed to provide sufficient mass for potential analysis of all of the COIs. Samples from the same increment but collected from different cores will be mixed together prior to removing aliquots for specific analysis.

**Number of Samples**

The overall design produces samples at 11 locations on Area 4a, resulting in good spatial coverage and a high vertical resolution in areas most likely affected by paper mill waste disposal, as well as soil mixing that may have occurred since the 1970s (Figure 9). The 22 surface and shallow subsurface samples will meet or exceed the requirements for calculation of an upper confidence limit (UCL) for human health risk assessment for this area. In addition to surface samples, soil cores will be collected at seven locations throughout Area 4a, which will be used for both nature and extent evaluations and CSM refinement (Figure 9), and which will address the most basic uncertainty (i.e., whether a buried waste deposit exists). Counting all increments at all locations (assuming cores penetrate to a depth at which there is a clear distinction between increments on the basis of grain size, lithology or other indicators [e.g., plant fragments] indicating the presence of undisturbed native materials, or to 14 feet, whichever is less), a total of 71 soil samples will be collected within Area 4a.

**Background Conditions**

Surface and shallow subsurface soils in background areas will be collected to allow comparison of soil samples from within the preliminary perimeter to background conditions as part of the nature and extent investigation. This sampling program is described in the Draft Soil SAP (Integral 2010) for off-site background areas. Analytes for these samples include all COIs for the purposes of this SAP Addendum.

#### *1.9.1.3 Analytical Approach*

A summary of the analysis approach is provided by Figure 9. Study Element 1 includes the following distinct types of analyses:

- **Detection frequency**. The detection frequency of each COI in all 71 soil samples will be calculated. Chemicals that are detected in 5 percent or fewer samples will not be evaluated for human health risks, and their nature and extent will not be described. Detection limits will be at or below conservative screening levels (Table 2).
- **Characterization of the lateral and vertical extent of contamination.** To characterize the nature and extent of contamination in surface and subsurface soils, all depth increments in cores, and both of the two depth increments in surface and shallow subsurface soil sampling locations will be submitted for chemical analysis. Concentrations of COIs and ancillary variables in all increments from these sample locations will be quantified. Results of chemical analysis of soils collected from background areas will be used to calculate an REV for each COI.
- **Comparison of Site soil conditions with background soils.** Evaluation of Site data relative to background conditions requires assessment of variability in background conditions. For this analysis, samples will be collected in the two surface intervals, 0–6 inch (0–15 cm) and 6–12 inches (15–30 cm), in 20 offsite background locations, as described in the Draft Soil SAP (Integral 2010), and comparisons with Site data will be made. Consistent with USEPA guidance for evaluation of background soils (USEPA 2002a), an upper 95th percentile or upper tolerance limit will be derived to characterize background conditions (i.e., REV).
- **Descriptive information on nature and extent of contamination, such as subsurface chemical profiles for each COI at each sampling location will be developed**. The lateral and vertical distribution of soil contamination will be described. The vertical distribution of COI concentrations at all locations will be evaluated qualitatively; vertical gradients will be used to interpret whether waste is present but buried, and whether contamination at the surface is the result of industrial activities not linked to paper mill waste handling (e.g., if a COI is present at the surface, but not elevated at the subsurface). For this latter evaluation, dioxins and furans will be considered an indicator of the influence of paper mill waste (RI/FS Work Plan, Appendix C).

Study Element 2 will include the following types of analyses (Figure 9):

- **Performance of risk based screens.** COI concentrations in each sample from surface and shallow subsurface increments will be compared to screening levels protective of human and ecological receptors. Those COIs with concentrations in a majority of samples that exceed screening levels will be addressed by a risk evaluation. Those COIs for which a majority of stations do not exceed conservative screening levels will not be considered further.
- **Characterization of exposures to human and ecological receptors using the Site.** Sampling of soils for Study Element 1 will provide data that are useful for evaluating exposure of human and ecological receptors to surface and shallow subsurface soils, at the 0–6 inch (0–15 cm) and the 6–12 inch (15–30 cm) depth intervals, respectively. Eleven locations will be sampled in Area 4a where potential exposure to contaminants is most likely. The data from these samples will be used to calculate exposure point concentrations to represent the central tendency and reasonable maximum exposures of each COI in soil for use in the risk assessments.
- **Comparison of exposures of human and ecological receptors to dioxins and furans in Site soils to those of background.** Exposures to soil contaminants on the Site will be compared with exposures at background locations to determine the extent to which Site soils pose an excess risk to people, reptiles, birds and mammals. Sampling of soils in background areas for Study Element 1 (discussed in Integral, 2010) will provide the necessary data for evaluation of background exposures.

Results of these analyses will be discussed with USEPA to determine whether a Phase II investigation is necessary, and to identify the remaining uncertainties that need to be resolved, if any, as shown in Figure 9.

### 1.9.2 DQOs for Study Element 3: Physical CSM and Fate and Transport Evaluation

The RI/FS will provide information to characterize the potential movement of impoundment-associated contaminants in soils from uplands to the aquatic environment as a result of surface erosion. This information is necessary to determine whether soils could contribute to sediment contamination, and thereby to evaluate whether remedial actions are needed.

The RI/FS will also include a limited study of groundwater involving the installation of three groundwater monitoring well pairs in the vicinity of the impoundments north of I-10. A complete SAP for collection and analyses of groundwater has been submitted to USEPA (Anchor QEA 2010a), and an addendum to this SAP will be developed to address groundwater sampling south of I-10 in phase II, if needed. For the study south of I-10, groundwater sampling will occur as part of Phase II only. It will be contingent upon the identification of significant contamination in soil south of I-10. If it becomes necessary to sample groundwater, wells will be installed at three locations, and soil samples will be collected from well cores and analyzed as described in the Groundwater SAP.

### 1.9.2.1 *Statement of the Problem*

The goal of Study Element 3 of the RI/FS is to determine primary physical and chemical processes controlling chemical fate and transport, and to use that information to refine the CSM for the Site. The problems to be addressed by the soil study pertain to:

- The topographical conditions of area south of I-10 that could facilitate transport of COI-contaminated soils from uplands to the aquatic environment
- The geological or chemical conditions that could result in contamination of groundwater with COIs.

#### 1.9.2.1.1 Topography of the Uplands

On the upland areas, if soils are contaminated with COIs originating from the impoundments, surface water runoff could erode soils into the aquatic environment. The topography of the uplands area within which soils will be sampled will determine the physical transport pathways that exist for the movement of soils to the aquatic environment.

#### 1.9.2.1.2 Soil Quality at Groundwater Well Locations

If significant subsurface soil contamination is identified, a problem relating to the understanding of fate and transport of COIs on the Site will be uncertainty about the subsurface geology and potential for COIs to enter groundwater. If a Phase II soil investigation is necessary, additional information on soil lithology and soil grain size at groundwater well locations will be obtained to address these uncertainties. Additional chemistry data may be needed to interpret results of groundwater sampling.

#### 1.9.2.2 *Sample Collection Design*

The sampling design for Study Element 3 in the area south of I-10 was developed in consideration of the following:

- The spatial and vertical resolution required to effectively describe possible surface water transport pathways on the uplands west of the impoundments

If a Phase II investigation involving groundwater sampling is required, the spatial distribution of groundwater wells will be considered in development of the groundwater sampling locations.

**Surface Topography**

LiDAR data developed in 2008 and describing the surface topography of the Site at a resolution appropriate for developing surface flow paths has been purchased from the Houston-Galveston Area Council. Both vendor-provided surface descriptions (such as 1-foot contour lines) and the bare-earth and all-return point data will be used to interpret the topography of the uplands west of the impoundments. Data will be interpreted using geographic information system software (ArcGIS) to interpolate a digital elevation model from the bare-earth point-return data and to perform an analysis of hydrologic flow paths. The digital elevation model will represent surface topography of the upland areas in 1-foot pixels, with a vertical accuracy of 0.22 foot. No field activities will be required.

**Soils at Groundwater Well Locations**

If a groundwater investigation is needed, three pairs of boreholes (one "shallow" and one "deep" in each pair) will be advanced in locations south of I-10 to enable the groundwater monitoring well pair installation, using an approach similar to that described in the Groundwater SAP (Anchor QEA 2010a). If this is necessary, soil samples (at 5-foot intervals) will be collected from the deeper of the two cores during the process of establishing groundwater monitoring wells. These samples will be archived and will be analyzed only if the results of the groundwater sampling suggest that soil contamination may lead to groundwater contamination. Observations on soil lithology (color, grain size, consistency, etc.) will be recorded following visual examination during drilling and sampling activities if they occur; these soil samples will be inspected and logged in accordance with American Society for Testing and Materials D2488 *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

### *1.9.2.3 Analytical Approach*

The analysis of data to be collected for Study Element 3 includes development of models of hydrologic flow paths on the surface of area where impoundments are suspected to have occurred south of I-10, and use in interpretation of groundwater sampling results.

**Surface Topography**

The ArcHydro extension in the ArcGIS software package will be used to delineate surface drainage flow paths of site topography. The 1-foot bare-earth digital elevation model grid will be used as input to produce a flow direction grid, in which grid cells indicate the flow direction defined by slope calculations using an eight-direction pour point model. The flow direction grid will be used as input to produce a flow accumulation grid, which records the number of cells that drain to a specific cell in the grid. Flow paths will be defined from the flow accumulation grid with the use of threshold drainage areas. Flow accumulation grid cells greater than the threshold drainage area will be classified as flow paths and all cells less than the threshold will be interpreted as areas contributing to the flow paths. The resulting flow paths will identify dominant drainage flow patterns on the upland area.

**Soils at Groundwater Well Locations**

The Groundwater SAP (Anchor QEA 2010a) describes the analysis of groundwater chemistry. If a groundwater study is necessary, groundwater samples are collected, and groundwater quality is found to be potentially affected by surface conditions, soil lithography at each of the groundwater well locations will be used in the evaluation of possible transport pathways from surface to groundwater. Soil samples collected during groundwater well boring and archived for possible chemical analyses (from the Beaumont formation and below) will be analyzed if information on soil and sediment chemistry that will be produced as a result of Study Elements 1 and 2 (Section 1.9.1) are found to be insufficient to interpret the groundwater chemistry data. For example, the vertical distribution of COIs in soils, as well as the geologic structure underlying the south impoundment, can be evaluated using lithography, grain size, and chemistry data for subsurface soils.

# 2 DATA GENERATION AND ACQUISITION

This section provides a brief description of the sampling design and outlines the procedures for collecting soil samples. Details of soil sampling methods are provided in the FSP Addendum (Appendix A).

## 2.1 Sampling Design

The Phase I sampling design for soil (Table 3) south of I-10 is summarized as follows:

### Soil Collection Areas

The soil collection area (Figure 7) includes:

- **Area 4a**. The area in which paper mill waste handling south of I-10 is most likely to have affected soil

### Soil Depth Intervals to be Sampled (Study Elements 1 and 2)

In Area 4a, soil samples will be collected at the following depth intervals:

- **Surface soil samples** will be collected from 0–6 inches (0–15 cm).
- **Shallow subsurface samples** will be collected from 6–12 inches (15–30 cm). Samples at 12–24 inches (30–60 cm) will be collected at core locations only.
- **Two-foot resolution soil cores** will be collected to the depth at each location at which a clear distinction between increments on the basis of grain size, lithology, or other indicators is observed, indicating the presence of undisturbed native materials, not to exceed a maximum of 14 feet, whichever is less. The top 1 foot at these stations will be collected as 0–6 and 6–12 inch intervals; the second 1 foot interval will be collected from 12–24 inches. Samples will be collected at each subsequent 2-foot interval.

Characterization of the top 2 feet (0 to 30 cm) of soils at each 2-foot resolution core will be possible by calculating a depth-weighted concentration using the concentrations in each of the three individual surface intervals, weighted by the percent of the total depth represented by each interval depth.

For all soil samples collected for Study Elements 1 and 2, an archive sample will be collected at each depth interval.

**Soil Depth Intervals to be Sampled (Study Element 3)**

If a Phase II investigation is necessary, at the location of deep groundwater wells, soil samples will be collected at 5-foot intervals from the top of the Beaumont formation and below during well boring. Soils will be composited across the full depth of the 5-foot interval and analyzed for grain size, as well as archived for chemistry as described in the Groundwater SAP (Anchor QEA 2010a).

**Sample Stations**

The following numbers of samples will be collected from Area 4:

- Surface and shallow subsurface pairs: 11 (from Area 4a)
- Cores with 2-foot intervals: 7

Locations of all of these stations are shown in Figure 7 and detailed in Appendix A.

## 2.2 Sampling Methods

Sampling methods that will be used to collect the soil samples are presented in Section 2.2 of the Draft Soil SAP (Integral 2010). Sampling methods are described in detail in the FSP (Appendix A of Integral 2010). This section specifically describes sampling methods required for collecting soil south of I-10 that differ from methods described in the Draft Soil SAP.

### *2.2.1 Surface Soil Samples*

All surface soil samples will be collected as described in the Draft Soil SAP (Integral 2010) Further details of the soil sampling methods, collection, and sample processing can be found in the draft FSP for the Site (Appendix A of Integral 2010). Locations of surface soil sampling stations are shown in Figure 8.

### 2.2.2 Soil Cores

Soil core sampling activities will be conducted under the direction of an Integral or Anchor QEA representative, in accordance with the applicable sections of the SOPs attached to Appendix A. Coring equipment and services will be provided by a contractor, which will be determined after the final approval of this SAP Addendum. Geoprobe® drilling methods used to collect subsurface soil samples cores will be advanced to a depth at which there is a clear distinction between increments on the basis of grain size, lithology, or other indicators (e.g., plant fragments) indicating the presence of undisturbed native materials or to 14 feet, whichever is less.

#### 2.2.2.1 Geoprobe® Sampling

Soil probes will be hydraulically pushed in 4-foot intervals to the target depth (refer to SOP-SL7). Samples will be collected using tube samplers equipped with new, clear polyethylene liners. The type of core to be collected is based on the depth increment: 2-foot intervals (Figure 9). Surface and shallow subsurface samples will also be collected at each core location by separating or separately collecting the 0–6 inch interval. The second depth interval will be collected from 6–12 inches bgs, and the third interval from 12–24 inches bgs. Subsequent samples will be collected from 2-foot intervals. The cores will be observed and logged using the Unified Soil Classification System.

The selected soil samples will be removed from the plastic tubing using a decontaminated, stainless-steel spoon and placed into laboratory-cleaned, wide-mouth glass jars and sealed with Teflon™-lined lids. Samples will be placed in a cooler with ice and submitted to an analytical laboratory for analysis within 24 hours. Soil samples will be placed in jars and shipped for chemical analysis as shown in the FSP tables (Appendix A). The remaining samples will be archived. Quality control samples will be collected as described below. Boreholes will be abandoned by backfilling in accordance with Texas regulations.

## 2.3 Sample Handling and QA Procedures

Sample handling and QC procedures are described in the Draft Soil SAP Sections 2.3 and 2.5, respectively (Integral 2010).

## 2.4 Laboratory and Analytical Methods

Laboratory and analytical methods are described in the Draft Soil SAP in Section 2.4. Those methods needed in addition to the ones described in the Draft Soil SAP are listed in Table 4.

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# TABLES

**Table 1**
**Chemicals of Interest**

| Class | Chemical |
|---|---|
| **Dioxins/Furans** | |
| | Dioxins and Furans |
| **Metals** | |
| | Aluminum |
| | Antimony |
| | Arsenic |
| | Barium |
| | Cadmium |
| | Chromium |
| | Cobalt |
| | Copper |
| | Lead |
| | Magnesium |
| | Manganese |
| | Mercury |
| | Nickel |
| | Silver |
| | Thallium |
| | Vanadium |
| | Zinc |
| **Polychlorinated Biphenyls** | |
| | Polychlorinated Biphenyls |
| **Semivolatile Organic Compounds** | |
| | Acenaphthene |
| | Fluorene |
| | Naphthalene |
| | Phenanthrene |
| | 2,4,6-Trichlorophenol |
| | 2,4-Dichlorophenol |
| | Pentachlorophenol |
| | Phenol |
| | Hexachlorobenzene |
| | 2,3,4,6-Tetrachlorophenol |
| | Carbazole |
| | 2,4,5-Trichlorophenol |
| | Bis(2-ethylhexyl)phthalate |
| **Volatile Organic Compounds** | |
| | Chloroform |
| | 1,2,4-Trichlorobenzene |
| | 1,2-Dichlorobenzene |
| | 1,3-Dichlorobenzene |
| | 1,4-Dichlorobenzene |
| | 1,2,3-Trichlorobenzene |

Table 2
Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| **Conventionals** | | | | | | |
| | Percent moisture (percent) | NV | NV | NV | NA | NA |
| | Total organic carbon (percent) | NV | NV | NV | 0.02 | 0.05 |
| **Dioxins/Furans (ng/kg)** | | | | | | |
| | 1,2,3,4,6,7,8-Heptachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0539 | 5 |
| | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | NV | NV | NV | 0.0482 | 5 |
| | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | NV | NV | NV | 0.0561 | 5 |
| | 1,2,3,4,7,8-Hexachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0616 | 5 |
| | 1,2,3,4,7,8-Hexachlorodibenzofuran | NV | NV | NV | 0.0688 | 5 |
| | 1,2,3,6,7,8-Hexachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0500 | 5 |
| | 1,2,3,6,7,8-Hexachlorodibenzofuran | NV | NV | NV | 0.0489 | 5 |
| | 1,2,3,7,8,9-Hexachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0525 | 5 |
| | 1,2,3,7,8,9-Hexachlorodibenzofuran | NV | NV | NV | 0.0521 | 5 |
| | 1,2,3,7,8-Pentachlorodibenzofuran | NV | NV | NV | 0.0501 | 5 |
| | 1,2,3,7,8-Pentachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0656 | 5 |
| | 2,3,4,6,7,8-Hexachlorodibenzofuran | NV | NV | NV | 0.0490 | 5 |
| | 2,3,4,7,8-Pentachlorodibenzofuran | NV | NV | NV | 0.0444 | 5 |
| | 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0664 | 1 |
| | 2,3,7,8-Tetrachlorodibenzofuran | NV | NV | NV | 0.0726 | 1 |
| | Octachlorodibenzo-*p* -dioxin | NV | NV | NV | 0.0990 | 10 |
| | Octachlorodibenzofuran | NV | NV | NV | 0.0782 | 10 |
| | Total tetrachlorinated dioxins | NV | NV | NV | NA | NA |
| | Total pentachlorinated dioxins | NV | NV | NV | NA | NA |
| | Total hexachlorinated dioxins | NV | NV | NV | NA | NA |
| | Total heptachlorinated dioxins | NV | NV | NV | NA | NA |
| | Total tetrachlorinated furans | NV | NV | NV | NA | NA |
| | Total pentachlorinated furans | NV | NV | NV | NA | NA |
| | Total hexachlorinated furans | NV | NV | NV | NA | NA |
| | Total heptachlorinated furans | NV | NV | NV | NA | NA |
| | Dioxins and Furans (2,3,7,8-TCDD TEQ) | 1.8E+01 | 8.5E+02 | 1.7E+01, 9.5E+02 [d] | NA | NA |
| **Metals (mg/kg)** | | | | | | |
| | Aluminum | NV | 9.9E+05 | -- | 6 | 10 |
| | Antimony | NV | 4.1E+02 | -- | 0.02 | 0.1 |
| | Arsenic | 1.6E+00 | 2.6E+02 | -- | 0.06 | 0.5 |
| | Barium | NV | 1.9E+05 | -- | 0.30 | 2 |
| | Cadmium | 9.3E+03 | 8.0E+02 | -- | 0.004 | 0.02 |
| | Chromium (III) [e] | NV | 1.5E+06 | -- | 0.03 | 0.2 |

Table 2

Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | Cobalt | 1.9E+03 | 3.0E+02 | -- | 0.3 | 2 |
| | Copper | NV | 4.1E+04 | -- | 0.6 | 2 |
| | Lead | NV | 8.0E+02 | -- | 3 | 20 |
| | Magnesium | NV | NV | NV | 0.04 | 4 |
| | Manganese | NV | 2.3E+04 | -- | 0.04 | 2 |
| | Mercury | NV | 3.4E+01 | -- | 0.002 | 0.02 |
| | Nickel | 6.4E+04 | 2.0E+04 | -- | 0.5 | 4 |
| | Silver | NV | 5.1E+03 | -- | 0.4 | 2 |
| | Thallium | NV | NV | 7.8E+01 [e] | 3 | 20 |
| | Vanadium | NV | 7.2E+01 | -- | 0.4 | 2 |
| | Zinc | NV | 3.1E+05 | -- | 0.3 | 2 |
| PCB Congeners, dioxin-like (µg/kg) | | | | | | |
| | PCB 77 | 1.1E+02 | NV | -- | 0.085 | 0.25 |
| | PCB 81 | 1.1E+02 | NV | -- | 0.09 | 0.25 |
| | PCB 105 | 1.1E+02 | NV | -- | 0.055 | 0.1 |
| | PCB 114 | 2.3E+00 | NV | -- | 0.06 | 0.25 |
| | PCB 118 | 1.1E+02 | NV | -- | 0.095 | 0.25 |
| | PCB 123 | 1.1E+02 | NV | -- | 0.075 | 0.25 |
| | PCB 126 | 1.1E-01 | NV | -- | 0.07 | 0.25 |
| | PCB 156 | 2.3E+01 | NV | -- | 0.065 | 0.25 |
| | PCB 157 | 2.3E+01 | NV | -- | 0.065 | 0.25 |
| | PCB 167 | 1.1E+03 | NV | -- | 0.055 | 0.25 |
| | PCB 169 | 1.1E+00 | NV | -- | 0.08 | 0.25 |
| | PCB 189 | 1.1E+02 | NV | -- | 0.09 | 0.25 |
| PCB Congeners (µg/kg) | | | | | | |
| | PCB 1 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 2 | NV | NV | NV | 0.002 | 0.005 |
| | PCB 3 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 4 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 5 | NV | NV | NV | 0.005 | 0.025 |
| | PCB 6 | NV | NV | NV | 0.005 | 0.025 |
| | PCB 7 | NV | NV | NV | 0.01 | 0.025 |
| | PCB 8 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 9 | NV | NV | NV | 0.01 | 0.025 |
| | PCB 10 | NV | NV | NV | 0.01 | 0.025 |
| | PCB 11 | NV | NV | NV | 0.05 | 0.5 |
| | PCB 12 | NV | NV | NV | 0.015 | 0.05 |
| | PCB 13 | NV | NV | NV | 0.015 | 0.05 |
| | PCB 14 | NV | NV | NV | 0.015 | 0.05 |
| | PCB 15 | NV | NV | NV | 0.09 | 0.25 |
| | PCB 16 | NV | NV | NV | 0.02 | 0.05 |

Table 2
Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | PCB 17 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 18 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 19 | NV | NV | NV | 0.02 | 0.05 |
| | PCB 20 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 21 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 22 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 23 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 24 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 25 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 26 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 27 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 28 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 29 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 30 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 31 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 32 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 33 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 34 | NV | NV | NV | 0.035 | 0.1 |
| | PCB 35 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 36 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 37 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 38 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 39 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 40 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 41 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 42 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 43 | NV | NV | NV | 0.045 | 0.25 |
| | PCB 44 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 45 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 46 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 47 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 48 | NV | NV | NV | 0.04 | 0.1 |
| | PCB 49 | NV | NV | NV | 0.055 | 0.25 |
| | PCB 50 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 51 | NV | NV | NV | 0.025 | 0.1 |
| | PCB 52 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 53 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 54 | NV | NV | NV | 0.06 | 0.25 |

Table 2
Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | PCB 55 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 56 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 57 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 58 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 59 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 60 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 61 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 62 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 63 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 64 | NV | NV | NV | 0.035 | 0.1 |
| | PCB 65 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 66 | NV | NV | NV | 0.08 | 0.25 |
| | PCB 67 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 68 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 69 | NV | NV | NV | 0.055 | 0.25 |
| | PCB 70 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 71 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 72 | NV | NV | NV | 0.08 | 0.25 |
| | PCB 73 | NV | NV | NV | 0.045 | 0.25 |
| | PCB 74 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 75 | NV | NV | NV | 0.03 | 0.1 |
| | PCB 76 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 78 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 79 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 80 | NV | NV | NV | 0.09 | 0.25 |
| | PCB 82 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 83 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 84 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 85 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 86 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 87 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 88 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 89 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 90 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 91 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 92 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 93 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 94 | NV | NV | NV | 0.06 | 0.25 |

Table 2

Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | PCB 95 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 96 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 97 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 98 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 99 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 100 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 101 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 102 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 103 | NV | NV | NV | 0.115 | 0.25 |
| | PCB 104 | NV | NV | NV | 0.115 | 0.25 |
| | PCB 106 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 107 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 108 | NV | NV | NV | 0.135 | 0.5 |
| | PCB 109 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 110 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 111 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 112 | NV | NV | NV | 0.125 | 0.5 |
| | PCB 113 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 115 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 116 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 117 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 119 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 120 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 121 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 122 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 124 | NV | NV | NV | 0.135 | 0.5 |
| | PCB 125 | NV | NV | NV | 0.075 | 0.25 |
| | PCB 127 | NV | NV | NV | 0.14 | 0.5 |
| | PCB 128 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 129 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 130 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 131 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 132 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 133 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 134 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 135 | NV | NV | NV | 0.055 | 0.25 |
| | PCB 136 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 137 | NV | NV | NV | 0.15 | 0.5 |

Table 2
Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | PCB 138 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 139 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 140 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 141 | NV | NV | NV | 0.045 | 0.1 |
| | PCB 142 | NV | NV | NV | 0.155 | 0.5 |
| | PCB 143 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 144 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 145 | NV | NV | NV | 0.16 | 0.5 |
| | PCB 146 | NV | NV | NV | 0.09 | 0.25 |
| | PCB 147 | NV | NV | NV | 0.09 | 0.25 |
| | PCB 148 | NV | NV | NV | 0.16 | 0.5 |
| | PCB 149 | NV | NV | NV | 0.09 | 0.25 |
| | PCB 150 | NV | NV | NV | 0.165 | 0.5 |
| | PCB 151 | NV | NV | NV | 0.055 | 0.25 |
| | PCB 152 | NV | NV | NV | 0.12 | 0.5 |
| | PCB 153 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 154 | NV | NV | NV | 0.055 | 0.25 |
| | PCB 155 | NV | NV | NV | 0.17 | 0.5 |
| | PCB 158 | NV | NV | NV | 0.05 | 0.1 |
| | PCB 159 | NV | NV | NV | 0.175 | 0.5 |
| | PCB 160 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 161 | NV | NV | NV | 0.175 | 0.5 |
| | PCB 162 | NV | NV | NV | 0.175 | 0.5 |
| | PCB 163 | NV | NV | NV | 0.105 | 0.25 |
| | PCB 164 | NV | NV | NV | 0.07 | 0.5 |
| | PCB 165 | NV | NV | NV | 0.18 | 0.5 |
| | PCB 166 | NV | NV | NV | 0.06 | 0.25 |
| | PCB 168 | NV | NV | NV | 0.065 | 0.25 |
| | PCB 170 | NV | NV | NV | 0.08 | 0.25 |
| | PCB 171 | NV | NV | NV | 0.185 | 0.5 |
| | PCB 172 | NV | NV | NV | 0.19 | 0.5 |
| | PCB 173 | NV | NV | NV | 0.185 | 0.5 |
| | PCB 174 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 175 | NV | NV | NV | 0.19 | 0.5 |
| | PCB 176 | NV | NV | NV | 0.195 | 0.5 |
| | PCB 177 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 178 | NV | NV | NV | 0.11 | 0.25 |
| | PCB 179 | NV | NV | NV | 0.115 | 0.25 |

Table 2
Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | PCB 180 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 181 | NV | NV | NV | 0.2 | 0.5 |
| | PCB 182 | NV | NV | NV | 0.2 | 0.5 |
| | PCB 183 | NV | NV | NV | 0.2 | 0.5 |
| | PCB 184 | NV | NV | NV | 0.2 | 0.5 |
| | PCB 185 | NV | NV | NV | 0.2 | 0.5 |
| | PCB 186 | NV | NV | NV | 0.205 | 0.5 |
| | PCB 187 | NV | NV | NV | 0.095 | 0.25 |
| | PCB 188 | NV | NV | NV | 0.115 | 0.25 |
| | PCB 190 | NV | NV | NV | 0.115 | 0.25 |
| | PCB 191 | NV | NV | NV | 0.21 | 0.5 |
| | PCB 192 | NV | NV | NV | 0.21 | 0.5 |
| | PCB 193 | NV | NV | NV | 0.07 | 0.25 |
| | PCB 194 | NV | NV | NV | 0.085 | 0.25 |
| | PCB 195 | NV | NV | NV | 0.215 | 0.5 |
| | PCB 196 | NV | NV | NV | 0.215 | 0.5 |
| | PCB 197 | NV | NV | NV | 0.125 | 0.5 |
| | PCB 198 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 199 | NV | NV | NV | 0.1 | 0.25 |
| | PCB 200 | NV | NV | NV | 0.125 | 0.5 |
| | PCB 201 | NV | NV | NV | 0.22 | 0.5 |
| | PCB 202 | NV | NV | NV | 0.22 | 0.5 |
| | PCB 203 | NV | NV | NV | 0.22 | 0.5 |
| | PCB 204 | NV | NV | NV | 0.225 | 0.5 |
| | PCB 205 | NV | NV | NV | 0.225 | 0.5 |
| | PCB 206 | NV | NV | NV | 0.225 | 0.5 |
| | PCB 207 | NV | NV | NV | 0.225 | 0.5 |
| | PCB 208 | NV | NV | NV | 0.23 | 0.5 |
| | PCB 209 | NV | NV | NV | 0.075 | 0.25 |
| Semivolatile Organic Compounds (SVOCs) (ug/kg) | | | | | | |
| | Acenaphthene | NV | 3.3E+07 | -- | 1.4 | 10 |
| | Fluorene | NV | 2.2E+07 | -- | 1.1 | 10 |
| | Naphthalene | 1.8E+04 | 6.2E+05 | -- | 2.3 | 10 |
| | Phenanthrene | NV | NV | 1.9E+07 [e] | 1.4 | 10 |
| | 2,4,6-Trichlorophenol | 1.6E+05 | 6.2E+05 | -- | 1.4 | 10 |
| | 2,4-Dichlorophenol | NV | 1.8E+06 | -- | 1.0 | 10 |
| | Pentachlorophenol | 9.0E+03 | 1.2E+07 | -- | 20 | 100 |
| | Phenol | NV | 1.8E+08 | -- | 2.0 | 30 |
| | Hexachlorobenzene | 1.1E+03 | 4.9E+05 | -- | 1.2 | 10 |

Table 2

Chemicals of Interest, Analytical Concentration Goals, and Method Detection/Reporting Limits

| Class | Chemical | USEPA Regional Screening Levels - Industrial Based Soil Screening Level for Human Health [a] | | Alternative Screening Level [b] | Method Detection Limit [c] | Method Reporting Limit [c] |
|---|---|---|---|---|---|---|
| | | carcinogenic endpoint | non-cancer endpoint | | | |
| | 2,3,4,6-Tetrachlorophenol | NV | 1.8E+07 | -- | 46 | 330 |
| | Carbazole | NV | NV | 9.5E+05 [e] | 1.3 | 10 |
| | 2,4,5-Trichlorophenol | NV | 6.2E+07 | -- | 1.5 | 10 |
| | Bis(2-ethylhexyl)phthalate | 1.2E+05 | 1.2E+07 | -- | 7.0 | 100 |
| Volatile Organic Compounds (VOCs) (ug/kg) | | | | | | |
| | Chloroform | 1.5E+03 | 1.1E+06 | -- | 0.22 | 20 |
| | 1,2,4-Trichlorobenzene | 9.9E+04 | 2.7E+05 | -- | 0.14 | 20 |
| | 1,2-Dichlorobenzene | NV | 9.8E+06 | -- | 0.063 | 5 |
| | 1,3-Dichlorobenzene | NV | NV | 8.8E+04 [e] | 0.07 | 5 |
| | 1,4-Dichlorobenzene | 1.2E+04 | 2.5E+07 | -- | 0.1 | 5 |
| | 1,2,3-Trichlorobenzene | NV | 4.9E+05 | -- | 0.048 | 5 |

**Notes and Sources:**

-- = Not applicable, USEPA screening level is available.

NV = No value available

Shaded = Shaded value represents the most appropriate screening level for evaluating chronic risks to industrial workers (i.e., in the case that a cancer and non-cancer value is available the final EPA SL is based on the lower of the two values. The interim PRGs were selected for dioxins/furans as these reflect more currently accepted science/regulatory levels).

a - USEPA, 2010. Regional Screening Values for Industrial/Commercial Soil. Available at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

b - Alternative values were provided only for dioxins/furans (to reflect current regulatory activity), and analytes for which no USEPA screening level is available.

c - Method detection limits and method reporting limits are on a dry weight basis.

d - USEPA, 2009. Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites. OSWER. 9200.3-56. December 2009. Available at: http://www.epa.gov/superfund/policy/remedy/pdfs/Interim_Soil_Dioxin_PRG_Guidance_12-30-09.pdf

e - TCEQ, 2010. TRRP Protective Concentration Levels. Tier 1 Commercial/Industrial PCLs for 30 acre source area. Available at: http://www.tceq.state.tx.us/remediation/trrp/trrppcls.html.
Values for thallium, phenanthrene, and 1,3-dichlorobenzene are based on non-cancer endpoints. Value for carbazole is derived from a carcinogenic endpoint.

f - The chromium (VI) screening level is lower than the chromium (III) level; however, speciation for chromium will not be performed so the screening value for chromium (VI) was not included as an analytical concentration goal.

**Table 3**
**Soil Sampling Design**

| Sample Group | Sampling Method and Depth | Number of Locations | Sample Locations | Analytes | Study Elements |
|---|---|---|---|---|---|
| Site surface soil, for human health and ecological risk assessment | Stainless steel shovel, trowel, or spoon<br>0-6 inches (0-15 cm) | 4 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment, fate and transport |
| Site shallow subsurface soil | Stainless steel shovel, hand auger, or hand corer<br>6-12 inches (15-30 cm) | 4 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment |
| Site soil core | Geoprobe®<br>0 to native material (14 ft max)<br>surface: 0-6 inches<br>shallow subsurface: 6-12 inches<br>remainder of top 2 feet: 12-24 inches<br>deep subsurface: 2-foot intervals | 7 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment; CSM |

**Notes**

COI = chemical of interest
CSM = conceptual site model
TOC = total organic carbon

## Table 4
## Proposed Laboratory Methods for Soil Samples

| Parameter | Laboratory | Sample Preparation | | Quantitative Analysis | |
|---|---|---|---|---|---|
| | | Protocol | Procedure | Protocol | Procedure |
| **Metals** | | | | | |
| Antimony | CAS-Kelso | USEPA 3050 | Strong acid digestion | USEPA 6020 | ICP/MS |
| Silver | CAS-Kelso | USEPA 3050 | Strong acid digestion | USEPA 6010B | ICP |
| **Organics** | | | | | |
| VOCs | CAS-Kelso | EPA 5035 | Purge and trap | EPA 8260B | GC/MS |

**Notes**

This table lists methods for chemicals not listed in the Soil Sampling and Analysis Plan.

CAS = Columbia Analytical Services
ICP = inductively coupled plasma-atomic emission spectrometry
ICP/MS = inductively coupled plasma/mass spectrometry
GC/MS = gas chromatography/mass spectrometry
USEPA = U.S. Environmental Protection Agency
VOC = volatile organic compound

# FIGURES

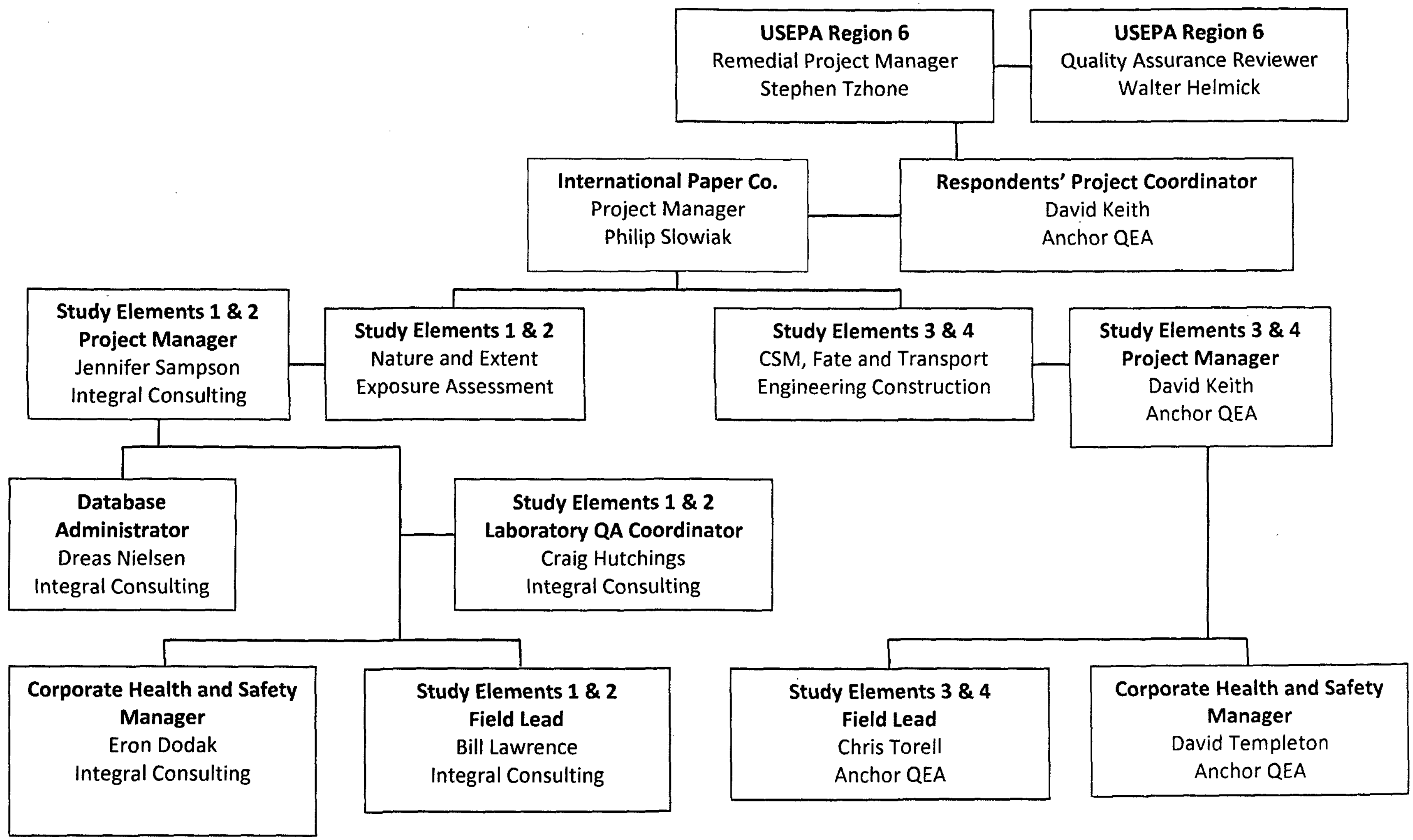


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**Figure 1**
Project Organization
SJRWP Soil SAP Addendum 1
SJRWP Superfund and IPC


ANCHOR QEA integral consulting inc.

0 800 Scale in Feet

USEPA's Preliminary Site Perimeter

Original (1966) Perimeter of the Northern Impoundments

Area of Soil Investigation South of I-10

[a] Designation of the sand separation area is intended to be a general reference to areas in which such activities are believed to have taken place based on visual observations of aerial photography from 1998 through 2002.

FEATURE SOURCES:
Aerial Imagery: 0.5-meter. Photo Date: 01/14/2009
Texas Strategic Mapping Program (StratMap), TNRIS

**Figure 2**
Overview of Soil Study Area
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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ANCHOR QEA
integral consulting inc.

0 800
Scale in Feet

- Approximate impoundment boundary derived from historical TSDH drawings.
- Boundary of a flooded area that is visible in a 1966 aerial photograph
- The smaller of two approximate impoundment boundaries proposed by EPA on the basis of a 1964 aerial photograph.
- The larger of two approximate impoundment boundaries proposed by EPA on the basis of historical drawings by the TSDH.
- USEPA's Preliminary Site Perimeter
- Original (1966) Perimeter of the Northern Impoundments

[a] Designation of the sand separation area is intended to be a general reference to areas in which such activities are believed to have taken place based on visual observations of aerial photography from 1998 through 2002.

FEATURE SOURCES: Aerial Photo USGS 1966

**Figure 3**
Possible Interpretations of the South Impoundment Perimeter
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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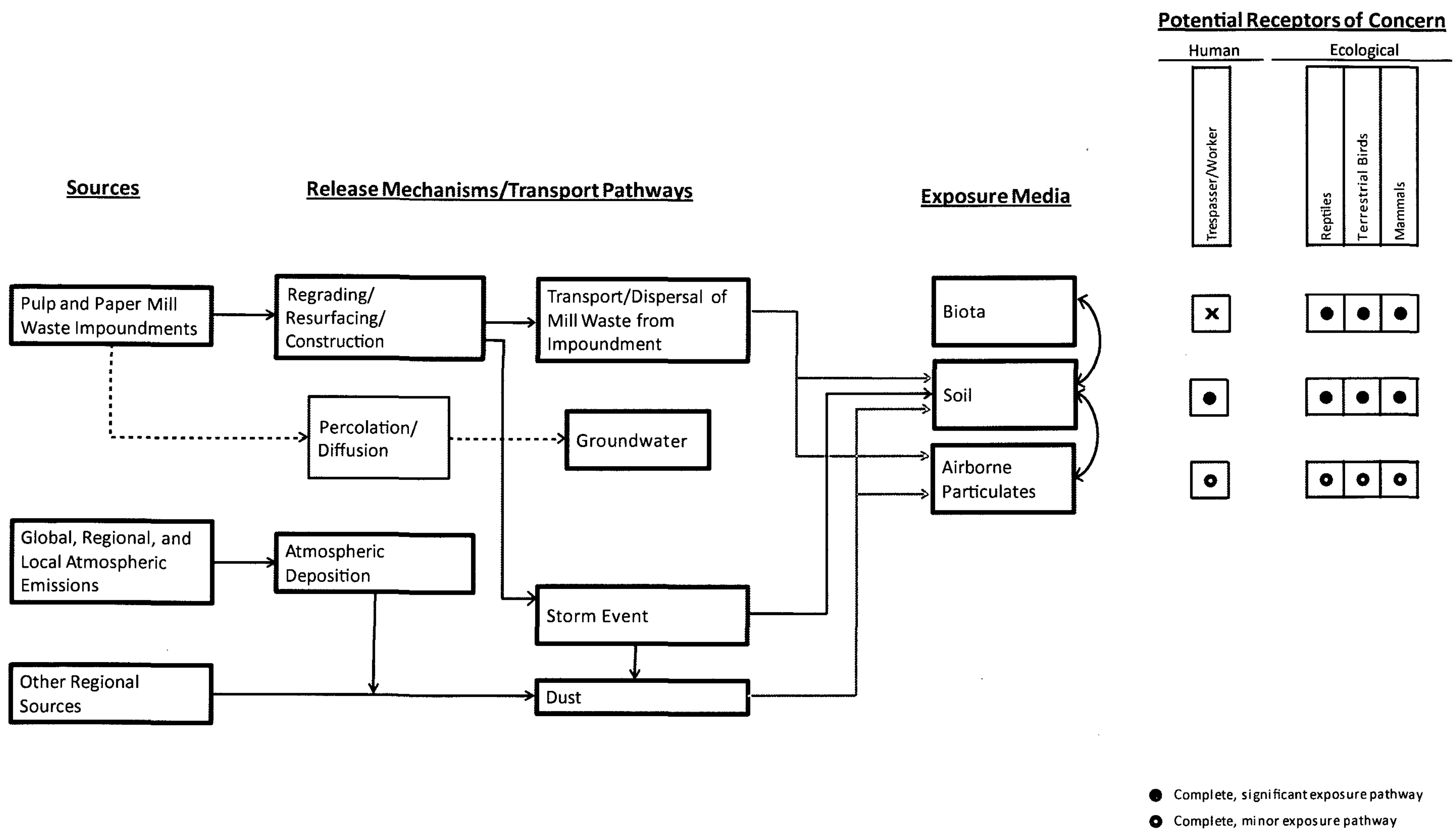


Notes:

Local sources may include industrial air emissions, vehicle or machinery fluid leaks, or other releases resulting from ongoing commercial activities on the site.
Curved lines indicate potential transport pathways for chemicals of potential concern among exposure media.

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**Figure 4**
Conceptual Site Model Pathways for the Area South of I-10
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

| Exposure Media | Exposure Route | Potential Human Receptors of Concern: Trespasser/Worker |
|---|---|---|
| Soil | Ingestion | ● |
| | Dermal contact | ● |
| Airborne Particulates | Inhalation | ○ |

Notes:

● Potentially complete and significant exposure pathway

○ Potentially complete but minor exposure pathway



**Figure 5**
Conceptual Site Model for Human Health
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

## Potential Ecological Receptors of Concern

| Exposure Media | Exposure Routes | Reptiles | Terrestrial Birds | Mammals |
|---|---|---|---|---|
| Biota | Ingestion | ● | ● | ● |
| Soil | Ingestion | ● | ● | ● |
| | Direct Contact | ○ | ○ | ○ |
| Airborne Particulates | Inhalation | ○ | ○ | ○ |

Notes:

● Potentially complete and significant exposure pathway

○ Potentially complete but minor exposure pathway



**Figure 6**
Conceptual Site Model for Ecological Exposures


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Soil Sampling Area

USEPA's Preliminary Site Perimeter

0 400

Scale in Feet

FEATURE SOURCES:
Aerial Imagery: 0.5-meter 2008/2009 DOQQs-
Texas Strategic Mapping Program (StratMap)

**Figure 7**
Overview of Area 4 and Subarea Locations
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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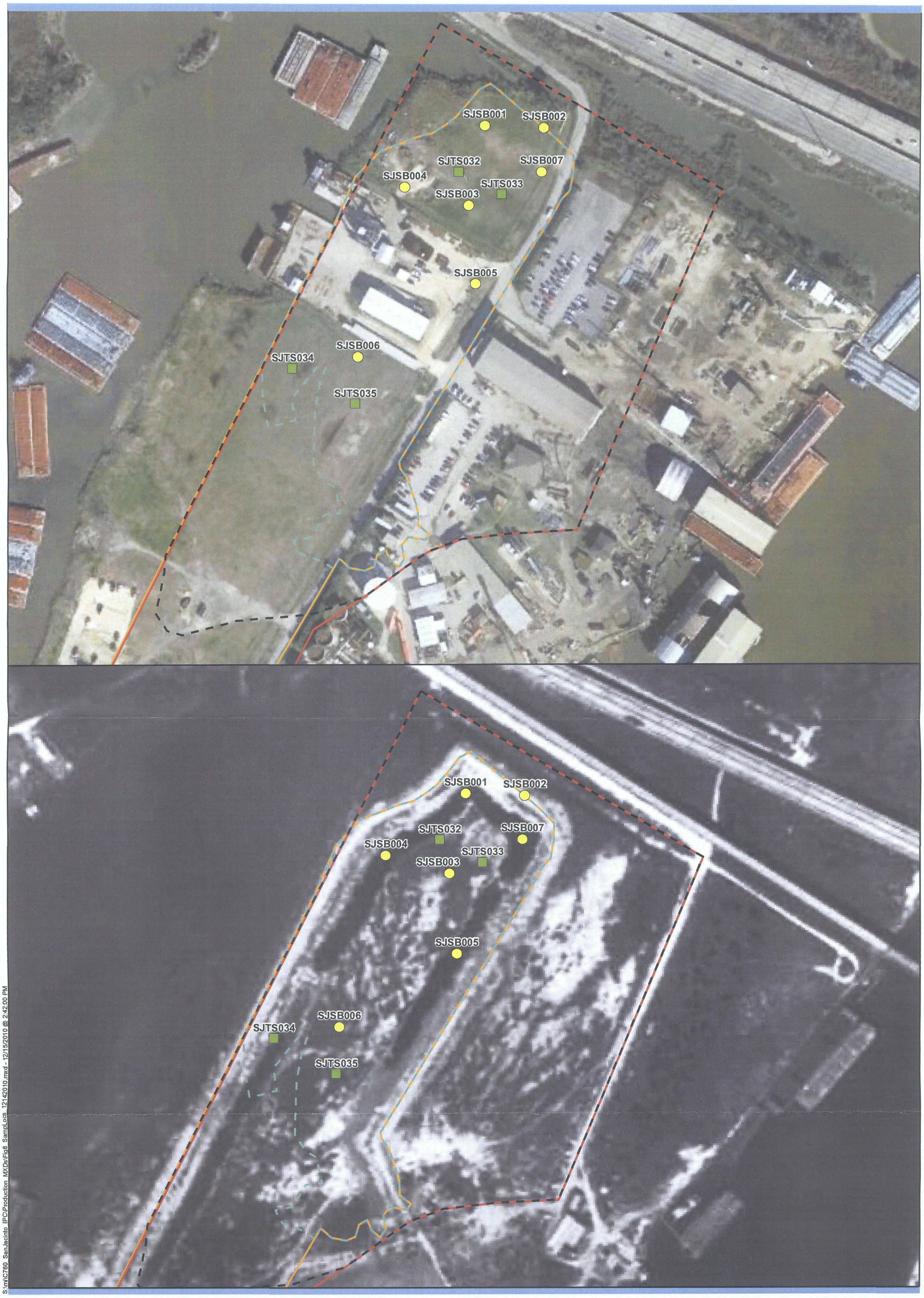


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0 — 400
Feet

- Soil Core at 2 Ft Intervals (Surface and Shallow Subsurface Sample Intervals: 0-6, 6-12 and 12-24 Inches)
- Surface and Shallow Subsurface Sample Stations (0-6 and 6-12 Inches)
- Digitized State Department of Health Hand Drawn Map
- Flooded Area on 1966 Aerial Photograph
- Texas State Department of Health May 1966 Hand-Drawn Map (TSDH 1966)
- USGS 1966 Aerial Photograph South Impoundment Perimeter

**Figure 8**
Sample Locations for Area 4
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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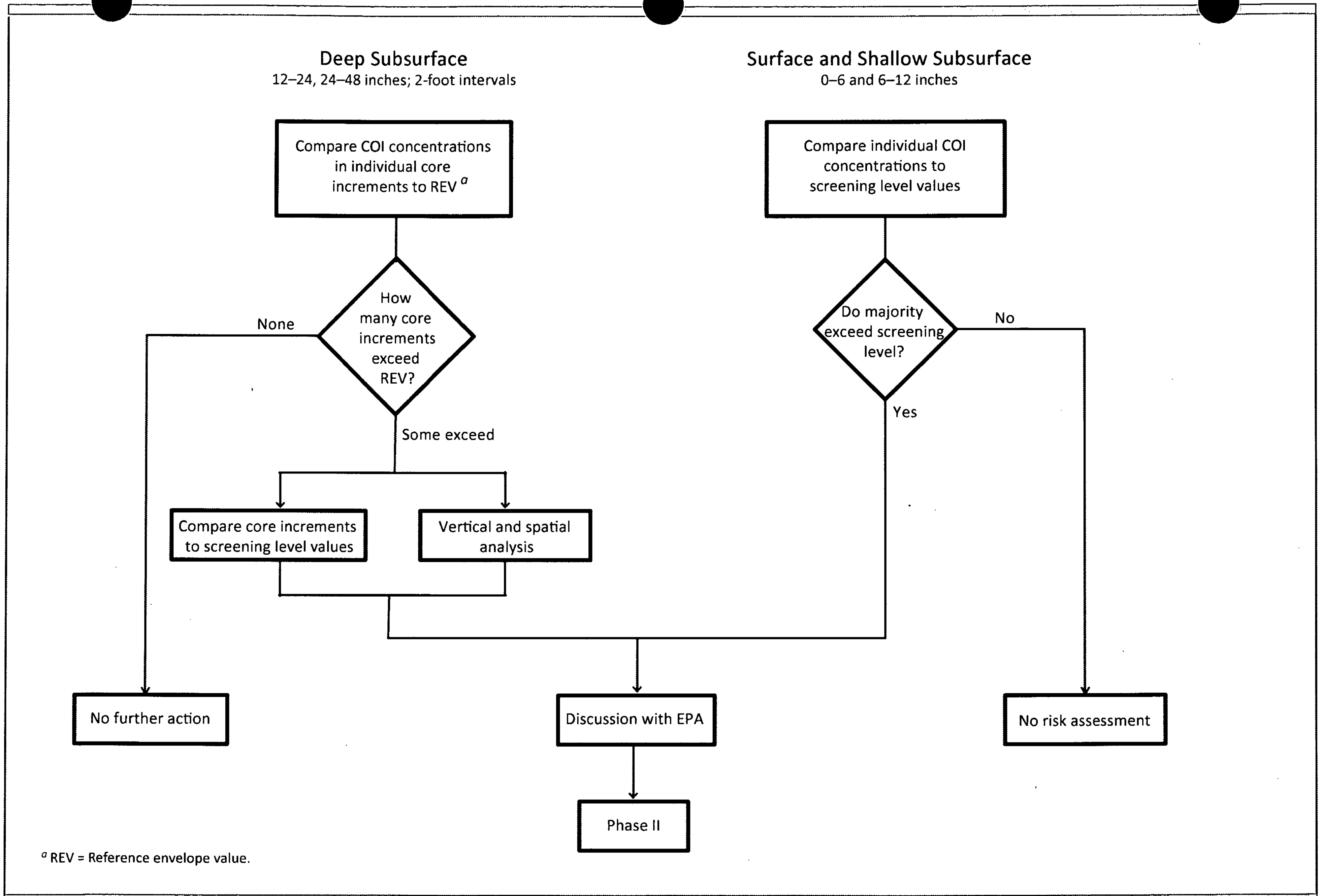


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**Figure 9**
Process Diagram for the Area South of I-10
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC


ANCHOR QEA integral

0 4,000
Scale in Feet

USEPA's Preliminary Site Perimeter
County Park

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**Figure 10**
Background Soil Sampling Locations
SJRWP Soil SAP Addendum 1
SJRWP Superfund/MIMC and IPC

# APPENDIX A
# SOIL FIELD SAMPLING PLAN, ADDENDUM 1
# SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

# SOIL FIELD SAMPLING PLAN, ADDENDUM 1 SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

**Prepared for**

International Paper Company

U.S. Environmental Protection Agency, Region 6

**Prepared by**


Integral Consulting Inc.

411 First Avenue South, Suite 550

Seattle, Washington 98104


**December 2010**

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## List of Figures



## List of Attachments

## LIST OF ACRONYMS AND ABBREVIATIONS

| Abbreviation | Definition |
|---|---|
| Anchor QEA | Anchor QEA, LLC |
| ASTM | American Society for Testing and Materials |
| COI | chemical of interest |
| DGPS | differential global positioning system |
| FSP | Field Sampling Plan |
| GPS | global positioning system |
| HASP | Health and Safety Plan |
| I-10 | Interstate Highway 10 |
| Integral | Integral Consulting Inc. |
| IPC | International Paper Company |
| MIMC | McGinnes Industrial Maintenance Corporation |
| QA | quality assurance |
| QA/QC | quality assurance and quality control |
| QC | quality control |
| RI/FS | Remedial Investigation and Feasibility Study |
| SAP | Sampling and Analysis Plan |
| Site | San Jacinto River Waste Pits Superfund Site |
| SJRWP | San Jacinto River Waste Pits |
| SOP | Standard Operating Procedure |
| TOC | total organic carbon |
| UAO | Unilateral Administrative Order |
| USEPA | U.S. Environmental Protection Agency |

# 1 INTRODUCTION

This Field Sampling Plan (FSP) Addendum has been prepared on behalf of International Paper Company (IPC), pursuant to the requirements of Unilateral Administrative Order (UAO), Docket No. 06-03-10, which was issued by the U.S. Environmental Protection Agency (USEPA) to IPC and McGinnes Industrial Maintenance Corporation (MIMC) on November 20, 2009 (USEPA 2009). The 2009 UAO directs IPC and MIMC to conduct a Remedial Investigation and Feasibility Study (RI/FS) for the San Jacinto River Waste Pits (SJRWP) Superfund Site in Harris County, Texas (the Site). Additional information on the Site history and a summary of existing data are provided in the Soil Sampling and Analysis Plan Addendum (SAP Addendum 1).

The Site consists of impoundments, built in the mid-1960s for disposal of paper mill wastes, and the surrounding areas containing sediments and soils potentially contaminated with the waste materials that had been disposed of in these impoundments. Two impoundments, together approximately 14 acres in size, are located on a 20-acre parcel immediately north of the I-10 Bridge and on the western bank of the San Jacinto River, in Harris County, Texas (Figure A-1). USEPA has identified an area south of I-10 to be investigated, based on historical documents and aerial photographs indicating that an additional impoundment was constructed south of I-10, on the peninsula of land directly south of the 20 acre parcel. This area was used as a disposal area in the mid-1960s for paper mill waste from the same mill as that disposed of in the two impoundments immediately north of I-10 (Figure A-1). A discussion of the history of this area south of I-10 is presented in the Soil SAP Addendum 1 (Integral 2010).

This document supplements information in the main Soil FSP (Appendix A of Integral 2010) and specifically addresses sampling within Area 4 of the Site. Field personnel conducting the work described in this addendum should have both this document, and Appendix A of the Soil SAP (Integral 2010) in hand when performing sampling. Surface (0–6 inches), shallow subsurface (6–12 inches) and deep subsurface samples (cores at 2 foot increments) will be collected south of I-10. Because the sampling at surface soil stations will be conducted in the same manner as for sampling in Areas 1–3 to the north of I-10, surface and shallow subsurface sampling methods and procedures can be found in the main FSP. This Addendum focuses on the execution of the sampling elements unique to Area 4, specifically the seven soil cores designed to address the nature and extent investigation south of I-10.

## 1.1 Overview

The soil sampling design for the RI/FS incorporates a number of different components (as discussed in the Soil SAP and Soil SAP Addendum). The individual study components for the investigation south of I-10 differ in the locations and depths at which soil is to be collected. Soil samples addressed in this document will be collected from the following areas (Figure A-2):

- **Area 4a**. The area in which waste handling south of I-10 is most likely to have affected soil.

These soil samples will be analyzed for all chemicals of interest (COIs; metals, polychlorinated biphenyls, volatile organic compounds, semivolatile organic compounds, and dioxins and furans), grain size, and total organic carbon (TOC). An archival sample will be collected for each sample for possible future analysis.

Investigation of the area south of I-10 may include two phases. This document addresses only activities to be performed in Phase I. The sampling design can be summarized as follows:

- **Area 4a:** Surface and shallow subsurface soil sampling and analysis of COIs at four locations from the area south of I-10 (stations SJTS032 through SJTS035; Figure A-2 and Table A-1). Surface and subsurface soil samples will be collected at all stations at depths of 0–6 inches (0-15 cm) and 6–12 inches (15–30 cm). In addition, seven soil borings (stations SJSB001 through SJSB007; Figure A-2 and Table A–1) will be collected. The analytical requirements for soil samples collected from Area 4a are as follows:
  - *Surface Soil Stations:* The surface and subsurface soil samples collected from depths of 0 to 6 inches (0 to 15 cm) and 6 to 12 inches (15 to 30 cm) from the 4 stations in Area 4a (Figure A–2) will be analyzed for COIs, TOC, and grain size. An additional soil sample in a unique jar will be collected from each of these sample intervals for possible future analyses.
  - *Soil Cores 2-foot intervals:* Deep subsurface soils will be sampled as soil cores with 2-foot intervals, at seven locations in Area 4a. The first interval will be

separated into three surface intervals: 0–6 inches, 6–12 inches (0–15 and 15–30 cm), and 12–24 inches (30-60 cm). All samples will be analyzed for COIs, TOC, and grain size. An additional soil jar will be collected from these sample intervals and archived for possible future analyses. If the coring device disrupts the process of collecting these top three intervals (e.g., inadvertently mixing the top two or three intervals), a sample of just these top intervals will be collected adjacent to the core using the methods described in the main Soil FSP (Integral 2010). Cores will be advanced to a depth at which there is a clear distinction between intervals on the basis of grain size, lithology or other indicators (e.g., plant fragments) suggesting the presence of native materials, and an absence of human disturbance, or to 14 feet, whichever is less.

If a groundwater study is determined to be necessary during Phase II, surface and subsurface soil samples will be collected during drilling of groundwater wells. Field methods and procedures are described in the Groundwater SAP. If additional soil sampling is required for a Phase II investigation, an additional SAP Addendum will be developed.

## 1.2 Document Organization

This FSP Addendum describes the field methods that will be used to collect soil cores from Area 4a of the Site in the 2010 soil study addressing nature and extent and exposure assessment. The background, rationale, data quality objectives, and overall study design are described in detail in the Soil SAP (Integral 2010) and Soil SAP Addendum 1. All of the elements (sample handling, field documentation, etc.) presented in the main FSP (Integral 2010) are applicable to this FSP Addendum 1 and are not repeated in this document. This FSP addendum focuses on the methods and field procedures that will be used to collect soil cores. The following documents are provided as additional attachments to the main FSP to support the sampling presented in this FSP Addendum 1:

- Attachment A1: Standard Operating Procedures. The only SOP unique to this FSP Addendum is SOP SL-07, Subsurface Soil Sampling. SL-07 describes the procedures that will be used to execute and collect soil cores. Other SOPs are found in Attachment A2 of the main Soil FSP (Appendix A to Integral 2010), address all other aspects of this field program, and must be used by field personnel.

- Attachment A2: Addendum 4 to the Overall Health and Safety Plan: Soil Sampling Health and Safety Plan. This document describes the specific requirements and procedures that will be implemented to minimize the safety risk to personnel who carry out the field study program for soil core sampling to be conducted south of I-10. It is an addendum to and references the project's overall health and safety plan (HASP; Anchor QEA 2009), and the HASP Addendum in the main Soil FSP (Appendix A, Attachment A1 to Integral 2010).
- Attachment A3. Field Forms. The only field form unique to sampling south of I-10 is the boring log, which is included as Attachment A3.
- Attachment A4: Exhibit 5 and Exhibit 52 summarizing the study design and analytes, respectively, as required by the UAO.

# 2 SAMPLING PROCEDURES

The following sections describe the detailed procedures and methods that will be used during the soil study in Area 4, including sampling procedures, recordkeeping, sample handling, storage, and field quality control (QC) procedures, to the extent that they differ from the main FSP (Appendix A of Integral 2010). Sample collection and processing will be conducted in accordance with the SOPs provided in Attachment A2 of the main FSP (Integral 2010) and Attachment A1 of this FSP Addendum. Field forms are provided in Attachment A3 of the main Soil FSP, and in Attachment A3 of this document Depending on field conditions, procedures specified in the referenced SOPs may be modified if necessary. Any deviations from approved FSPs will be documented in a field sampling report. All field activities will be conducted in accordance with the soil HASP addendum that is provided as Attachment A1 of the FSP (Integral 2010) and Attachment A2 of this FSP Addendum.

## 2.1 Field Survey and Sampling Methods

The following sections present the soil sampling methodology.

### *2.1.1 Field Equipment and Supplies*

Field equipment and supplies include sampling equipment, utensils, decontamination supplies, sample containers, coolers, shipping containers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., nitrile gloves) is required to minimize the possibility of cross-contamination between sampling locations. Additional information on protective wear required for this project is provided in Attachment A1 of the FSP (Integral 2010) and Attachment A2 of this FSP Addendum.

Surface soil samples (0–6 inches; 0–15 cm), and shallow subsurface samples (6–12 inches; 15–30 cm) will be collected from four locations and at each of the seven core locations in Area 4 using decontaminated stainless-steel shovels, trowels, or spoons (as described in the main FSP). A coring device (e.g., hand-held corers, hand auger, or equivalent type of equipment) or stainless steel shovel may be used for shallow subsurface soil sample collection (6–12 inches; 15–30 cm; and 12–24 inches; 30–60 cm).

There are seven soil cores targeted for sampling in Area 4a. Sampling activities will be conducted under the direction of an Integral or Anchor QEA representative, in accordance with the applicable sections of the SOPs (Attachment A1 of this FSP Addendum). Coring services will be provided by a contractor, which will be determined after the final approval of this FSP Addendum. A Geoprobe® will be used to collect deep subsurface soil samples. Continuous soil samples will be collected to a depth at which soil conditions indicate the presence of undisturbed native materials, or to a maximum depth of 14 feet below ground surface [bgs], whichever is reached first. It is anticipated that the water table may be encountered within 10–12 feet bgs. If the water table is not encountered within 11 feet bgs, coring will be continued until the water table is encountered and a sample at least 1-foot thick beneath the water table can be collected. However, cores will be collected no deeper than 14 feet bgs. Based on sediment cores from the impoundments north of I-10 and the elevation data for Area 4, we anticipate that the Beaumont Formation clay (refusal) occurs approximately at 20–40 feet bgs.

Sample jars, preservatives, laboratory-grade distilled water, coolers, and packaging material for the samples will be supplied by the analytical laboratory. Details on the types of sample containers are provided in the SAP Addendum and in Table A-2 of this FSP Addendum. The field lead and field personnel in charge of sample handling in the field will use a sample matrix table (Table A-3) as a QC check to ensure that all samples have been collected at a given station and to record sample and tag numbers. This table includes the total number and type of sample jars required for each analysis at each sampling station. Commercially available, pre-cleaned jars will be used for the samples, and the testing laboratories will maintain a record of certification from the suppliers. The bottle shipment documentation will include batch numbers. With this documentation, jars can be traced to the supplier, and bottle-wash analysis results can be reviewed. The bottle-wash certificate documentation will be archived in Integral's project file.

Sample containers will be clearly labeled at the time of sampling. Labels will include the task name, sample number, sampler's initials, analyses to be performed, and sample date and time. Sample numbering and identification procedures are described in more detail in Section 3.5 of the main FSP (Integral 2010) and in SOP AP-04, in Attachment A2 of the main Soil FSP.

### 2.1.2 Sample Location Positioning

Sample location positioning procedures are presented in Section 2.1.2 of the main Soil FSP (Integral 2010); the relevant SOP (SOP AP-06) is included in Attachment A2 of the same document. Proposed soil sampling location coordinates for Area 4 are provided in Table A-4.

### 2.1.3 Surface and Shallow Subsurface Soil Sample Collection

The equipment and procedures that will be used to collect surface and shallow subsurface soil samples during the 2010 soil study are discussed in the main Soil FSP, Section 2.1.3 (Integral 2010) and in SOP SL-06. The estimated numbers of field locations that will be sampled are listed in Table A-1. The holding time requirements for the soil samples following field collection are specified in Table A-2. Soil samples will be collected in accordance with the sample matrix table (Table A-3).

Surface soil samples (0–6 inches; 0–15 cm) and shallow subsurface samples (6–12 inch; 15–30 cm) may be collected with a variety of sampling equipment depending upon the conditions encountered in the field, including stainless-steel shovels, trowels, and spoons. The process for collecting surface soil samples is described in Section 2.1.3 of the main Soil FSP; the process for collecting shallow subsurface samples (6–12 inches; 15–30 cm) and the uppermost deep subsurface samples (12–24 inches; 30–60 cm) is described in Section 2.1.4 of the main Soil FSP. The boring log for recording observations when collecting surface, shallow subsurface, and the uppermost interval of the deep subsurface is provided in the main FSP, Attachment A3.

All soil samples will be analyzed for COIs, TOC, and grain size. Additional soil from each sample will be archived for possible future analyses (Table A-3).

Procedures for containing, labeling, storage and shipping are also described in the main Soil FSP.

### 2.1.4 Soil Core Collection

Soil cores will be collected using either a Geoprobe™ or a truck-mounted AMS power probe™ or a similar sampling device. A minimum internal diameter of 3 inches (7.6 cm) will be used for all core liners to ensure adequate soil mass for all the intended analyses. New, high density polyethylene, acetate, or similar type material will be used for the core liners. All drilling activities will be overseen by a geologist.

Soil probes will be hydraulically pushed in 4-foot intervals to the target depth, at a controlled rate to minimize agitation of the core (refer to SOP SL-07; Attachment A1). Collocated surface, shallow subsurface, and the uppermost deep subsurface samples will also be collected at each core location by separating or separately collecting those intervals (Section 2,1.3

Subsequent samples will be collected from 2-foot intervals. The cores will be observed and logged using the Unified Soil Classification System.

A core catcher will be inserted into the bottom end of the corer to prevent the core from slipping out when the corer is raised. After the core has been retrieved and secured, the liner that contains the sample will be removed from the corer barrel, the ends will be capped and the core will be inspected. Boreholes will be abandoned by backfilling in accordance with Texas regulations.

The surface interval of soil cores may occasionally become overly compacted or damaged by the boring process. In such cases, samples corresponding to the surface intervals (0–6, 6–12 and 12–24 inches) may be collected from a location within 2 feet of the boring using the same methods and procedures as for the surface and shallow subsurface samples, as described above in Sections 2.1.3 . A record of this substitution will be made in the boring log.

After the core is judged to be acceptable, end caps will be labeled with the station identifier, core section, and soil orientation. The core liner will then be placed on clean polyethylene sheeting, laid out horizontally and cut lengthwise, and the core will be split open. Cores will be inspected for predominant physical characteristics, photographs will be taken of the undisturbed soil, and soil characteristics will be described on a core profile form (to be provided by the selected field contractor).

The soil from each respective core section will be placed in a decontaminated stainless-steel or Teflon® bowl and homogenized to achieve a uniform texture and color using a decontaminated stainless-steel or Teflon® spoon. The homogenized sample from each section will be subsampled and transferred to pre-cleaned sample containers with Teflon®-lined lids (Table A-3). Soil touching the sides of the core tube will be excluded from each subsample, as will large rocks, cobbles, and vegetative matter. Immediately after sample containers are filled, they will be placed in a cooler on ice. Samples will be stored in accordance with storage requirements for each set of analytes as detailed in Table A-2. Any remaining soil mass will be used for the archive sample. Quality control samples will be collected as described in Section 2.2 below.

### 2.1.5 Equipment Decontamination

Decontamination procedures are addressed in Section 2.1.5 of the FSP (Integral 2010).

## 2.2 Field Quality Control Samples

Field QC samples will be used to assess sample variability and evaluate potential sources of contamination. The types of QC samples that will be collected for the 2010 soil study in Area 4 are described in this section. Detailed information on quality assurance and quality control (QA/QC) procedures, limits, and reporting are described in detail in the SAP (Integral 2010). The estimated numbers of field QC samples to be collected are listed in the sample matrix table (Table A-3). If QC problems are encountered, they will be brought to the attention of Integral's laboratory QA coordinator. Corrective actions, if appropriate, will be implemented to meet the task's data quality indicators.

Field QC samples will include field split samples, standard reference materials, equipment filter wipe blanks, and filter blanks. The Field QC samples will be collected in accordance with SOP SL-02 (Appendix A, Attachment A2 of Integral 2010). The following QC samples will be collected in the field and analyzed by the analytical laboratory for Area 4:

- Field split samples will be collected and analyzed to assess the variability associated with sample processing and laboratory variability. Blind field split samples will be collected at a minimum frequency of 1 field split sample per 20 soil samples. A total of 5 field split samples will be collected during the soil study (Table A-3) in Area 4. Samples will be assigned unique numbers and will not be identified as field splits to the laboratory. Field split samples will be collected from two surface, two shallow subsurface and three soil boring soil samples for chemical analysis. A minimum of one field split sample will be collected for each kind of sample collected.
- Standard reference materials are samples of known concentration that have typically undergone multilaboratory analyses using a standard method. Reference materials provide a measure of analytical performance and/or analytical method bias. One standard reference material for soil will be submitted from the field and analyzed for dioxins and furans.
- Equipment filter wipe blanks will be collected to help identify possible contamination from the sampling environment or from the sampling equipment (e.g., stainless-steel shovel, coring device, spoons, and mixing bowls). Equipment filter wipe blanks will be generated at approximately 5 percent of the soil sampling stations at a minimum, with at least one filter wipe blank collected for each type of sampling equipment. A total of 4 equipment filter wipe blanks will be collected during the soil study in

Area 4 (Table A-3). One equipment filter wipe will be prepared for each analysis type. If multiple analyses are requested, separate sets of filter wipes will be collected for each analysis type for each kind of sampling equipment used, as the equipment can be wiped down only once for each piece of filter paper. This ensures that the filter wipe result represents the most conservative estimate of cross contamination for each analysis type. (Note: Filter papers must be stored in their original box, wrapped carefully in three layers of aluminum foil, or contained in a glass jar. The filter paper box cannot be stored in plastic bags or containers.) All equipment wipe samples will be clearly noted in the field log (e.g., sample identifier, equipment type, date and time of collection, analysis, and filter lot number).

- Filter blanks are prepared in the field to evaluate potential background concentrations present in filter paper used for the equipment filter wipe blank. Filter blanks will be collected at a minimum frequency of one for each lot number of filter papers used for collecting the equipment wipe blanks.

## 2.3 Sample Packaging and Transport

Sample packaging and transport are addressed in Section 2.3 of the FSP (Integral 2010) and in SOP AP-01, in Attachment A2 of the main Soil FSP.

## 2.4 Study-Derived Wastes

Waste disposal is addressed in Section 2.4 of the FSP (Integral 2010).

# 3 FIELD DOCUMENTATION

The integrity of each sample from the time of collection to the point of data reporting must be maintained. Proper record-keeping and chain-of-custody procedures will allow samples to be traced from collection to final disposition. Representative photographs will be taken of each area where samples are collected. A photograph will be taken of each surface and shallow subsurface soil sample and each soil boring interval collected. Site photos from various angles and close-up views of the overall conditions will also be taken as necessary. Field documentation procedures will follow guidelines provided in SOP AP-02 (Appendix A, Attachment A2 of Integral 2010). Field forms are provided in Attachment A3 of this document, and of the main Soil FSP.

## 3.1 Field Log Book

All field activities and observations will be noted in a log book, as described in Section 3.1 of the FSP (Integral 2010).

## 3.2 Boring Logs

The field geologist will provide soil descriptions and characterize all soil core samples in accordance with SOPs SL-04 and SL-06 (Appendix A, Attachment A2 of Integral 2010) and ATSM guidelines (ASTM 2000) for the soils on a standard boring log (Attachment A2 )[1]. Boring logs will include the following information:

- Soil descriptions
- Date and time of collection of each soil sample
- Names of field personnel collecting and handling the samples
- Type of sampling equipment used (e.g., stainless steel, hand-corer, Geoprobe®)
- Sample station identification
- Sample number
- Length and depth intervals of each core section and estimated recovery (if applicable)

## 3.3 Chain-of-Custody Procedures

Sampling in Area 6 will follow the same chain-of-custody procedures as outlined in Section 3.3 of the FSP (Integral 2010), and in SOP AP-03 of Attachment A2 to the main FSP.

[1] Boring log forms for surface and shallow subsurface samples are provided in the main Soil FSP, Attachment A3.

## 3.4 Station Numbering

All stations will be assigned a unique identification code based on a designation scheme designed to suit the needs of the field personnel, data management, and data users. Soil sampling station numbers will include "SJ" to indicate San Jacinto followed by a two-letter code for the type of sample to be collected at a given location (TS = top soil; SB = soil boring). The letters will be followed by a three-digit number (e.g., 032, 035). The station numbers will increase as the stations move to the west and south. An example station number for a surface soil station in the 2011 soil study within Area 4 would be SJTS033.

Station numbers will not be recorded on sample labels or chain-of-custody forms to prevent analytical laboratories from seeing the relationships between samples and stations.

## 3.5 Sample Identifiers

Sampling in Area 4 will follow the same rules for the creation of individual sample identifiers, as described in Section 3.5 of the FSP (Integral 2010). Sample identification codes for deep subsurface samples collected between 24 inches and the bottom of the core will be created as follows: the station number (e.g., SJSB001), followed by a sample depth interval (e.g., 2–4 feet, 8–10 feet, etc). Example identifiers for a soil core station would be SJSB001-2-4, SJSB001-8-10, with additional intervals added as needed.

# 4 FIELD DATA MANAGEMENT AND REPORTING PROCEDURES

Data management and reporting procedures are discussed in Section 4 of the FSP (Integral 2010).

# 5 REFERENCES

Anchor QEA, 2009. Health and Safety Plan San Jacinto River Waste Pits Superfund Site. Prepared for McGinnes Industrial Maintenance Corporation, International Paper Company, and U.S. Environmental Protection Agency, Region 6. Anchor QEA, Ocean Springs, MS.

ASTM, 2000. Standard practice for description and identification of soils (Visual-Manual Procedure). Designation: D2488-00. American Society for Testing and Materials, West Conshohocken, PA.

Integral, 2010. Draft Sampling and Analysis Plan: Soil Study, San Jacinto Waste Pits Superfund Site. Prepared for McGinnes Industrial Maintenance Corporation, International Paper Company, and U.S. Environmental Protection Agency, Region 6. Integral Consulting, Seattle, WA.

USEPA, 2009. Unilateral Administrative Order for Remedial Investigation/Feasibility Study. U.S. EPA Region 6 CERCLA Docket No. 06-03-10. In the matter of: San Jacinto River Waste Pits Superfund Site Pasadena, Texas. International Paper Company, Inc. & McGinnes Industrial Management Corporation, respondents.

# TABLES

**Table A-1**
**Number of Locations Sampled Area 4**

| Sample Group | Sampling Method and Depth | Number of Locations | Sample Locations | Analytes | Study Elements |
|---|---|---|---|---|---|
| Site surface soil, for human health and ecological risk assessment | Stainless steel shovel, trowel, or spoon<br>0-6 inches (0-15 cm) | 4 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment, fate and transport |
| Site shallow subsurface soil | Stainless steel shovel, hand auger, or hand corer<br>6-12 inches (15-30 cm) | 4 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment |
| Site soil core | Geoprobe®<br>0 to native material (14 ft max)<br>surface: 0-6 inches<br>shallow subsurface: 6-12 inches<br>remainder of top 2 feet: 12-24 inches<br>deep subsurface: 2-foot intervals | 7 | Area 4a | COIs, TOC, and grain size | Nature and extent, exposure assessment; CSM |

**Notes**

COI = chemical of interest
CSM = conceptual site model
TOC = total organic carbon

**Table A-2**
**Sample Containers, Preservation, and Holding Time Requirements**

| Matrix | Container [a] | | Laboratory | Parameter | Preservation | Holding Time | Sample Size [b] |
|---|---|---|---|---|---|---|---|
| | Type | Size | | | | | |
| **Soil** | | | | | | | |
| | WMG | 8 oz. | CAS - Kelso | TOC | 4±2 °C | 28 days | 1 g |
| | WMG | 8 oz. | CAS - Kelso | Metals | 4±2 °C | 6 months | 10 g |
| | WMG | 8 oz. | CAS - Kelso | Mercury | 4±2 °C | 28 days | 5 g |
| | WMG | 16 oz. | CAS - Kelso | Grain size | 4±2 °C | 6 months | 100 g |
| | WMG | 8 oz. | CAS - Houston | Dioxins/furans | 4±2 °C/Deep frozen (-20 °C) [c]/ -10 °C [d] | 1 year/1 year [e] | 50 g |
| | WMG | 8 oz. | CAS - Houston | PCBs | 4±2 °C/Deep frozen (-20 °C) [c]/ -10 °C [d] | 1 year/1 year [e] | 50 g |
| | WMG | 8 oz. | CAS - Kelso | SVOCs | 4±2 °C/ Deep frozen (-20 °C) [c] | 1 year [f] | 50 g |
| | WMG / with septa | 4 oz. | CAS - Kelso | VOCs | 4±2 °C | 14 days | 5 g |
| | WMG | 16 oz. | TBD | Archival | 4±2 °C/ Deep frozen (-20 °C) [c] | TBD | 100 g |
| **Equipment Filter Wipe Blanks** | | | | | | | |
| | WMG | 4 oz. | CAS - Kelso | Metals | 4±2 °C | 6 months | 1 wipe |
| | WMG | 4 oz. | CAS - Kelso | Mercury | 4±2 °C | 28 days | 1 wipe |
| | WMG | 4 oz. | CAS - Houston | Dioxins/furans | 4±2 °C | 1 year/1 year [e] | 1 wipe |
| | WMG | 4 oz. | CAS - Houston | PCBs | 4±2 °C | 1 year/1 year [e] | 1 wipe |
| | WMG | 4 oz. | CAS - Kelso | SVOCs | 4±2 °C | 14 days/40 days [e] | 1 wipe |

**Notes**

SVOC = semivolatile organic compound
VOC = volatile organic compound
TOC = total organic carbon
WMG = wide mouth glass
PCB = polychlorinated biphenyl
a - The size and number of containers may be modified by the analytical laboratory.
b - Sample sizes may be modified once laboratory selection is made.
c - Samples will be shipped to the laboratory on ice at 4±2 °C. Once received at the laboratory, samples will be stored at -20 °C.
d - Extracts will be stored at -10 °C.
e - Holding time for samples prior to extraction/ holding time for extracts.
f - Holding time for frozen samples is 1 year.

**Table A-3**
**Field Sample Collection Matrix Area 4**

| Station Number | Sample Identifier | Sample Number | Sample Depth | Sample Type | Soil Sample Analyses | | | | | | Blank Filter Wipes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Primary | | | | | Archival | Ghost Wipes | | Whatman Grade 42 Filter Papers | | |
| | | | | | TOC, Metals (including mercury) | Grain Size | SVOCs | VOCs | Dioxins and Furans, PCBs | TBD | Metals | Mercury | Dioxins and Furans | PCB congeners | SVOCs |
| | | | | | 8 oz WMG[a] | 16 oz WMG[a] | 8 oz WMG[a] | 4 oz WMG[a] | 8 oz WMG[a] | 16 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] |
| | | | | | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2°C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C |
| **Soil Sample Area 4 Surface and Shallow Subsurface Soils** | | | | | | | | | | | | | | | |
| ☐ SJTS032 | SJTS032-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS032-A-DUP | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Field Split | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS032-B | SL _ _ _ _ | 6 - 12 inches (15 -30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| ☐ SJTS033 | SJTS033-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS033-B | SL _ _ _ _ | 6 - 12 inches (15 -30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| ☐ FW Blank | SSFW-921S | FW _ _ _ _ | Surface Sampling Equipment | Equipment filter wipe blank[d] | NA | NA | NA | NA | NA | NA | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ |
| ☐ FW Blank | SSFW-922C | FW _ _ _ _ | Subsurface Sampling Equipment | Equipment filter wipe blank[d] | NA | NA | NA | NA | NA | NA | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ |
| ☐ Filter Paper | SSFB-923 | FB _ _ _ _ | Filter paper | Filter blank[e] | NA | NA | NA | NA | NA | NA | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ |
| ☐ SJTS034 | SJTS034-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS034-B | SL _ _ _ _ | 6 - 12 inches (15 -30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS034-B-DUP | SL _ _ _ _ | 6 - 12 inches (15 -30 cm) | Field Split | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| ☐ SJTS035 | SJTS035-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJTS035-B | SL _ _ _ _ | 6 - 12 inches (15 -30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |

Table A-3
Field Sample Collection Matrix Area 4

| Station Number | Sample Identifier | Sample Number | Sample Depth | Sample Type | Soil Sample Analyses | | | | | | Blank Filter Wipes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Primary | | | | | Archival | Ghost Wipes | | Whatman Grade 42 Filter Papers | | |
| | | | | | TOC, Metals (including mercury) | Grain Size | SVOCs | VOCs | Dioxins and Furans, PCBs | TBD | Metals | Mercury | Dioxins and Furans | PCB congeners | SVOCs |
| | | | | | 8 oz WMG$^a$ | 16 oz WMG$^a$ | 8 oz WMG$^a$ | 4 oz WMG$^a$ | 8 oz WMG$^a$ | 16 oz WMG$^a$ | 4 oz WMG$^a$ | 4 oz WMG$^a$ | 4 oz WMG$^a$ | 4 oz WMG$^a$ | 4 oz WMG$^a$ |
| | | | | Sample Type | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C/ Deep frozen (-20°C)$^b$/-10 °C | 4±2 °C/ Deep frozen (-20°C)$^b$/-10 °C | 4±2°C | 4±2 °C | 4±2 ºC | 4±2 °C | 4±2 °C |
| **Soil Sample Area 4 Soil Cores** | | | | | | | | | | | | | | | |
| ☐ SJSB001 | SJSB001-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-C-DUP | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Field Split | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB001-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| ☐ SJSB002 | SJSB002-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB002-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |

**Table A-3**
**Field Sample Collection Matrix Area 4**

| Station Number | Sample Identifier | Sample Number | Sample Depth | Sample Type | Soil Sample Analyses | | | | | | Blank Filter Wipes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Primary | | | | | Archival | Ghost Wipes | | Whatman Grade 42 Filter Papers | | |
| | | | | | TOC, Metals (including mercury) | Grain Size | SVOCs | VOCs | Dioxins and Furans, PCBs | TBD | Metals | Mercury | Dioxins and Furans | PCB congeners | SVOCs |
| | | | | | 8 oz WMG[a] | 16 oz WMG[a] | 8 oz WMG[a] | 4 oz WMG[a] | 8 oz WMG[a] | 16 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] |
| | | | | | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2°C | 4±2 °C | 4±2 ºC | 4±2 °C | 4±2 °C |
| ☐ SJSB003 | SJSB003-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB003-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| ☐ FW Blank | SBFW-924C | FW _ _ _ _ | Subsurface Sampling Equipment | Equipment filter wipe blank[d] | NA | NA | NA | NA | NA | NA | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ |
| ☐ SJSB004 | SJSB004-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-B-DUP | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Field Split | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |
| | SJSB004-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | Tag #________ | NA | NA | NA | NA | NA |

Table A-3
Field Sample Collection Matrix Area 4

| Station Number | Sample Identifier | Sample Number | Sample Depth | Sample Type | Soil Sample Analyses | | | | | | Blank Filter Wipes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Primary | | | | | Archival | Ghost Wipes | | Whatman Grade 42 Filter Papers | | |
| | | | | | TOC, Metals (including mercury) | Grain Size | SVOCs | VOCs | Dioxins and Furans, PCBs | TBD | Metals | Mercury | Dioxins and Furans | PCB congeners | SVOCs |
| | | | | | 8 oz WMG[a] | 16 oz WMG[a] | 8 oz WMG[a] | 4 oz WMG[a] | 8 oz WMG[a] | 16 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] |
| | | | | Sample Type | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2°C | 4±2 °C | 4±2 ºC | 4±2 °C | 4±2 °C |
| ☐ SJSB005 | SJSB005-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-2-4-DUP | SL _ _ _ _ | 2 - 4 feet | Field Split | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB005-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| ☐ FW Blank | SBFW-925C | FW _ _ _ _ | Subsurface Sampling Equipment | Equipment filter wipe blank[d] | NA | NA | NA | NA | NA | NA | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ |
| ☐ SJSB006 | SJSB006-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB006-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |

**Table A-3**
**Field Sample Collection Matrix Area 4**

| Station Number | Sample Identifier | Sample Number | Sample Depth | Sample Type | Soil Sample Analyses | | | | | | Blank Filter Wipes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Primary | | | | | Archival | Ghost Wipes | | Whatman Grade 42 Filter Papers | | |
| | | | | | TOC, Metals (including mercury) | Grain Size | SVOCs | VOCs | Dioxins and Furans, PCBs | TBD | Metals | Mercury | Dioxins and Furans | PCB congeners | SVOCs |
| | | | | | 8 oz WMG[a] | 16 oz WMG[a] | 8 oz WMG[a] | 4 oz WMG[a] | 8 oz WMG[a] | 16 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] | 4 oz WMG[a] |
| | | | | Sample Type | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2 °C/ Deep frozen (-20°C)[b]/-10 °C | 4±2°C | 4±2 °C | 4±2 ºC | 4±2 °C | 4±2 °C |
| ☐ SJSB007 | SJSB007-A | SL _ _ _ _ | 0 - 6 inches (0-15 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-B | SL _ _ _ _ | 6 - 12 inches (15 - 30 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-C | SL _ _ _ _ | 12 - 24 inches (30 - 60 cm) | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-2-4 | SL _ _ _ _ | 2 - 4 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-4-6 | SL _ _ _ _ | 4 - 6 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-6-8 | SL _ _ _ _ | 6 - 8 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-8-10 | SL _ _ _ _ | 8 - 10 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-10-12 | SL _ _ _ _ | 10 - 12 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| | SJSB007-12-14 | SL _ _ _ _ | 12 - 14 feet | Normal | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ | NA | NA | NA | NA | NA |
| ☐ FW Blank | SBFW-926C | FW _ _ _ _ | Subsurface Sampling Equipment | Equipment filter wipe blank[d] | NA | NA | NA | NA | NA | NA | Tag #______ | Tag #______ | Tag #______ | Tag #______ | Tag #______ |

**Definitions**
NA = not applicable
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
WMG = wide mouth glass

a - The size and number of containers may be modified by the analytical laboratory.
b - A unique numeric sample tag number will be attached to each sample container. If the amount of material (i.e., everything associated with a single sample number) is too large for a single container, each container will have the same sample number and a different sample label with a unique sample tag number. A sample will also be split between containers if a different preservation technique is used for each container (e.g., freezing archive sample). The sample tag number will appear on the COC forms. Tag numbers are used by laboratories only to confirm that they have received all of the containers that were filled and shipped. Date will be reported by sample number.
c - Blind field split samples will be collected at a minimum frequency of 1 field split sample per 20 sediment samples.
d - A filter wipe blank sample will be collected at a minimum frequency of 1 per 20 soil samples. One equipment wipe will be prepared for each analysis type. Because multiple analyses types are requested for this study, separate tests of filter wipes will be collected for each analysis type for each kind of sampling equipment used, as the equipment can be wiped down only once with each piece of filter paper. This ensures that the filter wipe result represents the most conservative estimate of cross contamination for each analysis type.
e - Filter blanks are prepared in the field to evaluate potential background concentration present in filter paper used for the equipment filter wipe blank. Filter blanks will be collected at a minimum frequency of one for each lot number of filter papers used for collecting the equipment wipe blank. The filter lot number will be clearly noted in the field logbook.

**Table A-4**
**Station Coordinates, Sample Type, Sampling Interval, and Corresponding Analysis for Area 4**

| Station Number | Sample Type | Sampling Intervals | Analysis | Coordinates[a] | |
|---|---|---|---|---|---|
| | | | | X | Y |
| SJSB001 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3216167.07113 | 13857035.70050 |
| SJSB002 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3216297.08957 | 13857030.86880 |
| SJSB003 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3216131.83629 | 13856861.87500 |
| SJSB004 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3215991.87430 | 13856901.60789 |
| SJSB005 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3216148.27917 | 13856688.04960 |
| SJSB006 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3215890.51591 | 13856529.41210 |
| SJSB007 | Core with 2 ft Interval; Surface Intervals 0-6; 6-12; 12-24 inches | 0-6; 6-12; 12-24 inches; 24-in intervals up to 14 feet | COIs, TOC, grain size | 3216292.10467 | 13856935.33814 |
| SJTS032 | Surface and Shallow Subsurface Sampling Location | 0-6 in., 6-12 in. | COIs, TOC, grain size | 3216110.69526 | 13856934.69380 |
| SJTS033 | Surface and Shallow Subsurface Sampling Location | 0-6 in., 6-12 in. | COIs, TOC, grain size | 3216204.65504 | 13856885.36510 |
| SJTS034 | Surface and Shallow Subsurface Sampling Location | 0-6 in., 6-12 in. | COIs, TOC, grain size | 3215747.00668 | 13856504.07750 |
| SJTS035 | Surface and Shallow Subsurface Sampling Location | 0-6 in., 6-12 in. | COIs, TOC, grain size | 3215884.57661 | 13856427.58160 |

**Notes**
COI = chemical of interest
TOC = total organic carbon

a - NAD 1983; State Plane Texas South Central FIPS 4204; US feet

# FIGURES


USEPA's Preliminary Site Perimeter

Original (1966) Perimeter of the Northern Impoundments

Area of Soil Investigation South of I-10

0 800

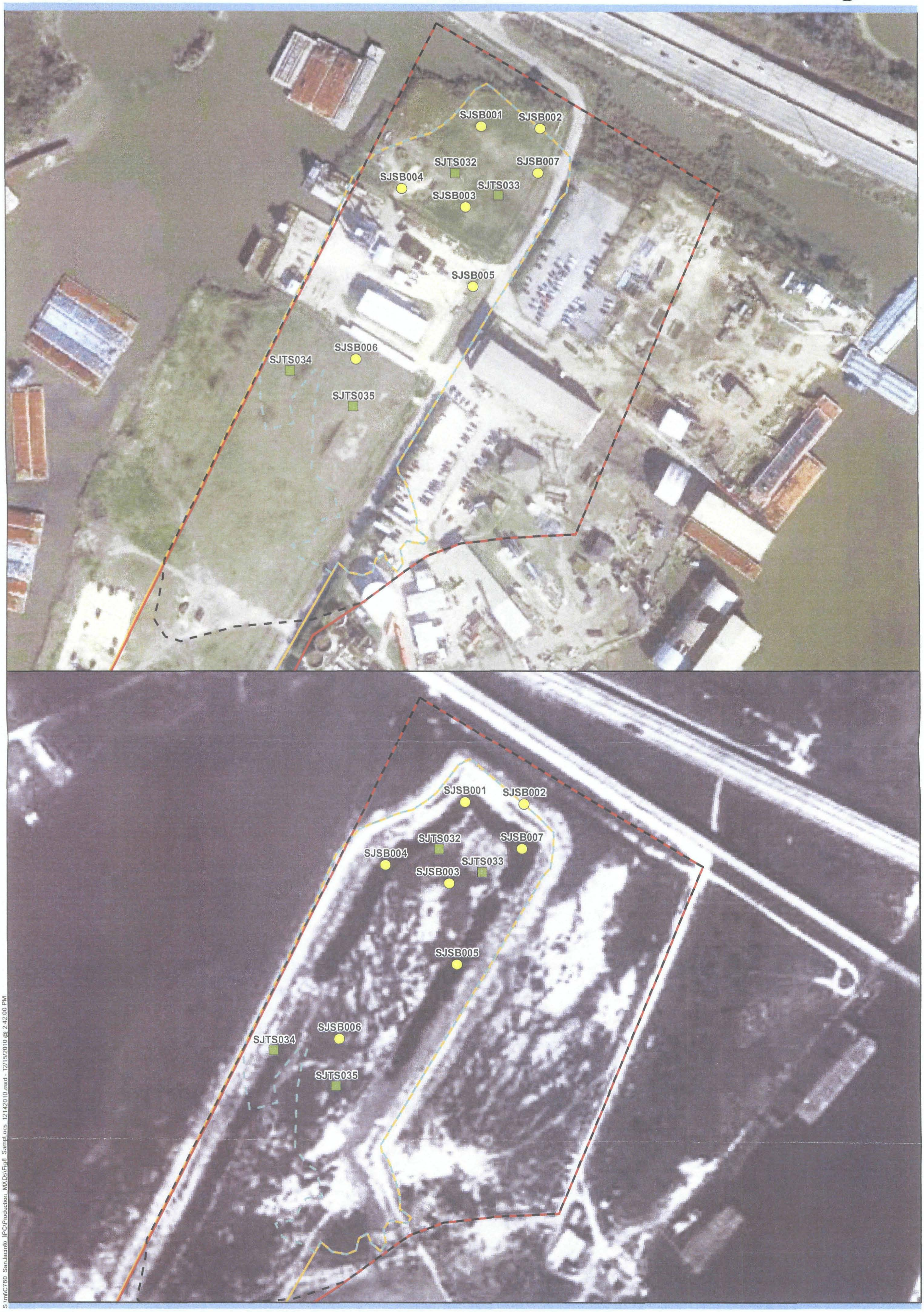
Scale in Feet

[a] Designation of the sand separation area is intended to be a general reference to areas in which such activities are believed to have taken place based on visual observations of aerial photography from 1998 through 2002.

FEATURE SOURCES:
Aerial Imagery: 0.5-meter, Photo Date: 01/14/2009
Texas Strategic Mapping Program (StratMap), TNRIS

**Figure A-1**
Overview of Soil Study Area
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

DRAFT
DO NOT QUOTE OR CITE




ANCHOR QEA integral

0 400

Feet

- Soil Core at 2 Ft Intervals (Surface and Shallow Subsurface Sample Intervals: 0-6, 6-12 and 12-24 Inches)
- Surface and Shallow Subsurface Sample Stations (0-6 and 6-12 Inches)
- Digitized State Department of Health Hand Drawn Map
- Flooded Area on 1966 Aerial Photograph
- Texas State Department of Health May 1966 Hand-Drawn Map (TSDH 1966)
- USGS 1966 Aerial Photograph South Impoundment Perimeter

**Figure A-2**
Sample Locations for Area 4
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

**DRAFT**
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# ATTACHMENT A1

# STANDARD OPERATING PROCEDURES

# STANDARD OPERATING PROCEDURE SL-06

# LOGGING OF SOIL BOREHOLES

integral consulting inc.

# STANDARD OPERATING PROCEDURE (SOP) SL-06

# LOGGING OF SOIL BOREHOLES

## SCOPE AND APPLICATION

This SOP describes how to complete a Soil Boring Log form, which must be completed for Integral projects where soil boring techniques are performed during field exploration. A correctly completed form contains all of the information that must be recorded in the field to adequately characterize soil boreholes.

These procedures are adapted from ASTM D-2488-00. Field staff are encouraged to examine ASTM D-2488-00 in its entirety. This SOP represents minor modifications to emphasize environmental investigations rather than geotechnical investigations, for which the standards were written. Because each environmental project is unique and because job requirements can vary widely, the minimum standards presented may need to be supplemented with additional technical descriptions or field test results. However, all soil boring field logs, regardless of special project circumstances, must include information addressed in this SOP to achieve the minimum acceptable standards required by Integral.

## LOG FORM INFORMATION

**Project Number**—Use the standard contract number.

**Client**—Identify the name of the client and the project site location.

**Location**—If stations, coordinates, mileposts, or similar markers are applicable, use them to identify the location of the project. If this information is not available, identify the facility (e.g., 20 ft NE of Retort #1).

**Drilling Method**—Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, cable tool) and the name of the drill rig (e.g., Mobil B 61, CME 55).

**Diameter**—Provide the diameter of the borehole. If the borehole has variable diameters, provide the depth interval for each diameter.

**Sampling Method**—Identify the type of sampler(s) used (e.g., standard split spoon, Dames & Moore sampler, grab).

**Drilling Contractor**—Provide the name of the drilling contractor.

**Integral Staff**—Enter the name(s) of Integral staff members performing logging and sampling activities.

**Water Level Information**—Provide the date, time, depth to static water, and casing depth. Generally, water levels should be taken each day before resuming drilling and at the completion of drilling. If water is not encountered in the boring, this information should be recorded.

**Boring Number**—Provide the boring number. A numbering system should be developed prior to drilling that does not conflict with other site information, such as previous drilling or other sampling activities.

**Sheet**—Number the sheets consecutively for each boring and continue the consecutive depth numbering.

**Drilling Start and Finish**—Provide the drilling start and finish dates and times.

For consecutive sheets, provide (at a minimum) the job number, boring number, and sheet number.

## TECHNICAL DATA

**Sampler Type**—Provide the sampler type (e.g., SS = split spoon, G = grab).

**Depth of Casing**—Enter the depth of the casing below ground surface immediately prior to sampling.

**Driven/Recovery**—Provide the length that the sampler was driven and the length of sample recovered in the sampler. This column would not apply to grab samples.

**Sample Number/Sample Depth**—Provide the sample number. The sample numbering scheme should be established prior to drilling. One method is to use the boring number and consecutive alphabetical letters. For instance, the first sample obtained from boring MW-4 would be identified as 4A, the second would be identified as 4B, and so on. Another method for sample identification is naming the boring number with the depth. For example, the sample from Boring 1 at 10 ft would be labeled B1-10'. The depth of the sample is the depth of the casing plus the length to the middle of the recovered sample to the nearest 0.1 ft. Typically, split spoon samplers are 18 in. long. Samples should be obtained from the middle of the recovered sample. The depth of the sample with the casing at 10 ft would then be 10.7 ft.

**Number of Blows**—For standard split-spoon samplers, record the number of blows for each 6 in. of sampler penetration. A typical blow count of 6, 12, and 14 is recorded as 6/12/14. Refusal is a penetration of less than 6 in. with a blow count of 50. A partial penetration of 50 blows for 4 in. is recorded as 50/4". Total blows will be recorded for nonstandard split spoons (e.g., 5-ft tube used for continuous sampling).

**Blank Columns**—Two blank columns are provided. Use these columns for site-specific information, usually related to the chemicals of concern. Examples for a hydrocarbon site would be sheen and photoionization detector readings of the samples.

**Depth**—Use a depth scale that is appropriate for the complexity of the subsurface conditions. The boxes located to the right of the scale should be used to graphically indicate sample locations as shown in the example.

**Surface Conditions**—Describe the surface conditions (e.g., paved, 4-in. concrete slab, grass, natural vegetation and surface soil, oil-stained gravel).

**Soil Description**—Enter the soil classification and definition of soil contacts using the format described in SOP SL-04, *Field Classification of Soil.*

**Comments**—Include all pertinent observations. Drilling observations might include drilling chatter, rod-bounce (boulder), sudden differences in drilling speed, damaged samplers, and malfunctioning equipment. Information provided by the driller should be attributed to the driller. Information on possible contaminants might include odor, staining, color, and presence or absence of some indicator of contamination. Describe what it is that indicates contamination (e.g., fuel-like odor, oily sheen in drill cuttings, yellow water in drill cuttings).

# ATTACHMENT 1. SOIL BORING LOG FORM

integral

319 SW Washington St., Suite 1150
Portland, OR 97204
(503) 284-5545

STATION NUMBER ______
PROJECT ______
LOCATION ______
PROJECT NUMBER ______
LOGGED BY ______



| SAMPLE INFORMATION | | | | | | STRATA | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| Sample ID | Depth | Time | Tag No. | % Recov. | Depth (Feet) | | USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc. |
| | | | | | 2-- | | |
| | | | | | 4-- | | |
| | | | | | 6-- | | |
| | | | | | 8-- | | |
| | | | | | 10-- | | |
| | | | | | 12-- | | |
| | | | | | 14-- | | |

DRILLING CONTRACTOR ______
DRILLING METHOD ______
SAMPLING EQUIPMENT ______
DRILLING STARTED ______
COORDINATES ______
SURFACE ELEVATION ______
DATUM ______

Location Sketch

# ATTACHMENT 2. ASTM D 2488 – 00, STANDARD PRACTICE FOR DESCRIPTION AND IDENTIFICATION OF SOILS (VISUAL-MANUAL PROCEDURE)

Designation: D 2488 – 00

INTERNATIONAL

# Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)[1]

This standard is issued under the fixed designation D 2488; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope *

1.1 This practice covers procedures for the description of soils for engineering purposes.

1.2 This practice also describes a procedure for identifying soils, at the option of the user, based on the classification system described in Test Method D 2487. The identification is based on visual examination and manual tests. It must be clearly stated in reporting an identification that it is based on visual-manual procedures.

1.2.1 When precise classification of soils for engineering purposes is required, the procedures prescribed in Test Method D 2487 shall be used.

1.2.2 In this practice, the identification portion assigning a group symbol and name is limited to soil particles smaller than 3 in. (75 mm).

1.2.3 The identification portion of this practice is limited to naturally occurring soils (disturbed and undisturbed).

NOTE 1—This practice may be used as a descriptive system applied to such materials as shale, claystone, shells, crushed rock, etc. (see Appendix X2).

1.3 The descriptive information in this practice may be used with other soil classification systems or for materials other than naturally occurring soils.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements see Section 8.

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[2]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 2113 Practice for Diamond Core Drilling for Site Investigation[2]

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and rock as Used in Engineering Design and Construction[3]

D 4083 Practice for Description of Frozen Soils (Visual-Manual Procedure)[2]

## 3. Terminology

3.1 *Definitions*—Except as listed below, all definitions are in accordance with Terminology D 653.

NOTE 2—For particles retained on a 3-in. (75-mm) US standard sieve, the following definitions are suggested:
*Cobbles*—particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve, and
*Boulders*—particles of rock that will not pass a 12-in. (300-mm) square opening.

3.1.1 *clay*—soil passing a No. 200 (75-μm) sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. For classification, a clay is a fine-grained soil, or the

[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.07 on Identification and Classification of Soils.

Current edition approved Feb. 10, 2000. Published May 2000. Originally published as D 2488 – 66 T. Last previous edition D 2488 – 93ε1.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**

fine-grained portion of a soil, with a plasticity index equal to or greater than 4, and the plot of plasticity index versus liquid limit falls on or above the "A" line (see Fig. 3 of Test Method D 2487).

3.1.2 *gravel*—particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

*coarse*—passes a 3-in. (75-mm) sieve and is retained on a ¾-in. (19-mm) sieve.

*fine*—passes a ¾-in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve.

3.1.3 *organic clay*—a clay with sufficient organic content to influence the soil properties. For classification, an organic clay is a soil that would be classified as a clay, except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.4 *organic silt*—a silt with sufficient organic content to influence the soil properties. For classification, an organic silt is a soil that would be classified as a silt except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.5 *peat*—a soil composed primarily of vegetable tissue in various stages of decomposition usually with an organic odor, a dark brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.

3.1.6 *sand*—particles of rock that will pass a No. 4 (4.75-mm) sieve and be retained on a No. 200 (75-μm) sieve with the following subdivisions:

*coarse*—passes a No. 4 (4.75-mm) sieve and is retained on a No. 10 (2.00-mm) sieve.

*medium*—passes a No. 10 (2.00-mm) sieve and is retained on a No. 40 (425-μm) sieve.

*fine*—passes a No. 40 (425-μm) sieve and is retained on a No. 200 (75-μm) sieve.

3.1.7 *silt*—soil passing a No. 200 (75-μm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry. For classification, a silt is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index less than 4, or the plot of plasticity index versus liquid limit falls below the "A" line (see Fig. 3 of Test Method D 2487).

## 4. Summary of Practice

4.1 Using visual examination and simple manual tests, this practice gives standardized criteria and procedures for describing and identifying soils.

4.2 The soil can be given an identification by assigning a group symbol(s) and name. The flow charts, Fig. 1a and Fig. 1b for fine-grained soils, and Fig. 2, for coarse-grained soils, can be used to assign the appropriate group symbol(s) and name. If the soil has properties which do not distinctly place it into a specific group, borderline symbols may be used, see Appendix X3.

NOTE 3—It is suggested that a distinction be made between *dual symbols* and *borderline symbols*.

*Dual Symbol*—A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used to indicate that the soil has been identified as having the properties of a classification in accordance with Test Method D 2487 where two symbols are required. Two symbols are required when the soil has between 5 and 12 % fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

*Borderline Symbol*—A borderline symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that do not distinctly place the soil into a specific group (see Appendix X3).

## 5. Significance and Use

5.1 The descriptive information required in this practice can be used to describe a soil to aid in the evaluation of its significant properties for engineering use.

5.2 The descriptive information required in this practice should be used to supplement the classification of a soil as determined by Test Method D 2487.

5.3 This practice may be used in identifying soils using the classification group symbols and names as prescribed in Test Method D 2487. Since the names and symbols used in this practice to identify the soils are the same as those used in Test Method D 2487, it shall be clearly stated in reports and all other appropriate documents, that the classification symbol and name are based on visual-manual procedures.

5.4 This practice is to be used not only for identification of soils in the field, but also in the office, laboratory, or wherever soil samples are inspected and described.

5.5 This practice has particular value in grouping similar soil samples so that only a minimum number of laboratory tests need be run for positive soil classification.

NOTE 4—The ability to describe and identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and manual characteristics.

5.6 When describing and identifying soil samples from a given boring, test pit, or group of borings or pits, it is not necessary to follow all of the procedures in this practice for every sample. Soils which appear to be similar can be grouped together; one sample completely described and identified with the others referred to as similar based on performing only a few of the descriptive and identification procedures described in this practice.

5.7 This practice may be used in combination with Practice D 4083 when working with frozen soils.

NOTE 5—Notwithstanding the statements on precision and bias contained in this standard: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing. Users of this test method are cautioned that compliance with Practice D 3740 does not in itself assure reliable testing. Reliable testing depends on several factors; Practice D 3740 provides a means for evaluating some of those factors.

## 6. Apparatus

6.1 *Required Apparatus*:

6.1.1 *Pocket Knife or Small Spatula.*

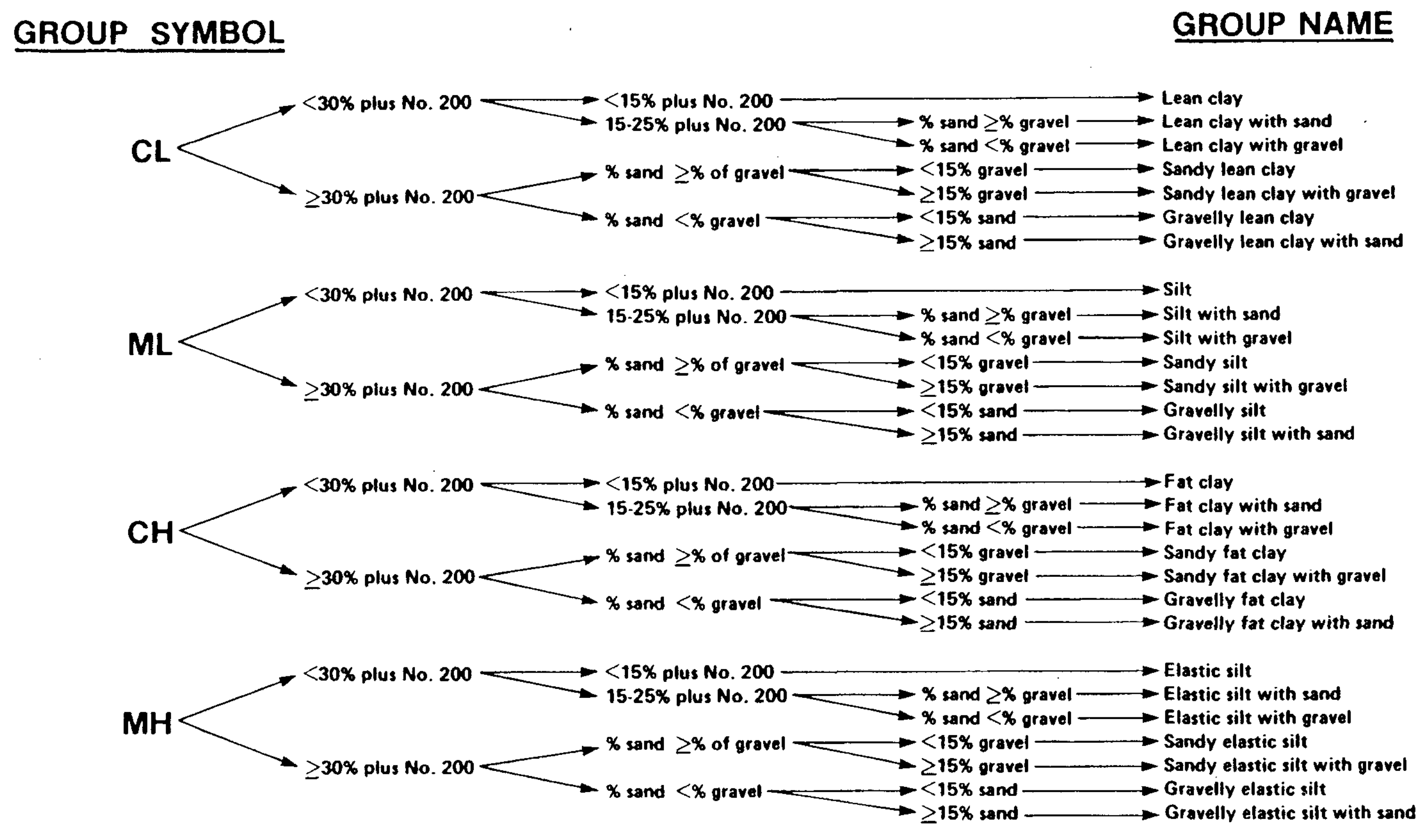
6.2 *Useful Auxiliary Apparatus*:

6.2.1 *Small Test Tube and Stopper* (or jar with a lid).

6.2.2 *Small Hand Lens.*

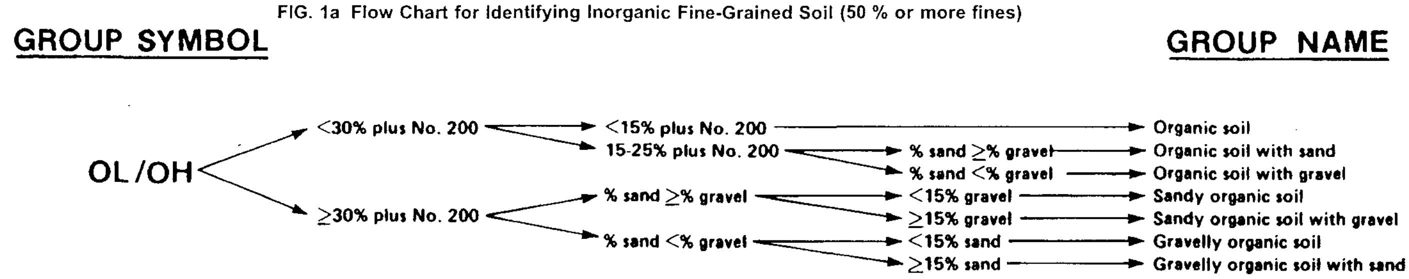
## 7. Reagents

7.1 *Purity of Water*—Unless otherwise indicated, references




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

to water shall be understood to mean water from a city water supply or natural source, including non-potable water.

7.2 *Hydrochloric Acid*—A small bottle of dilute hydrochloric acid, HCl, one part HCl (10 *N*) to three parts water (This reagent is optional for use with this practice). See Section 8.

## 8. Safety Precautions

8.1 When preparing the dilute HCl solution of one part concentrated hydrochloric acid (10 *N*) to three parts of distilled water, slowly add acid into water following necessary safety precautions. Handle with caution and store safely. If solution comes into contact with the skin, rinse thoroughly with water.

8.2 **Caution**—Do not add water to acid.

## 9. Sampling

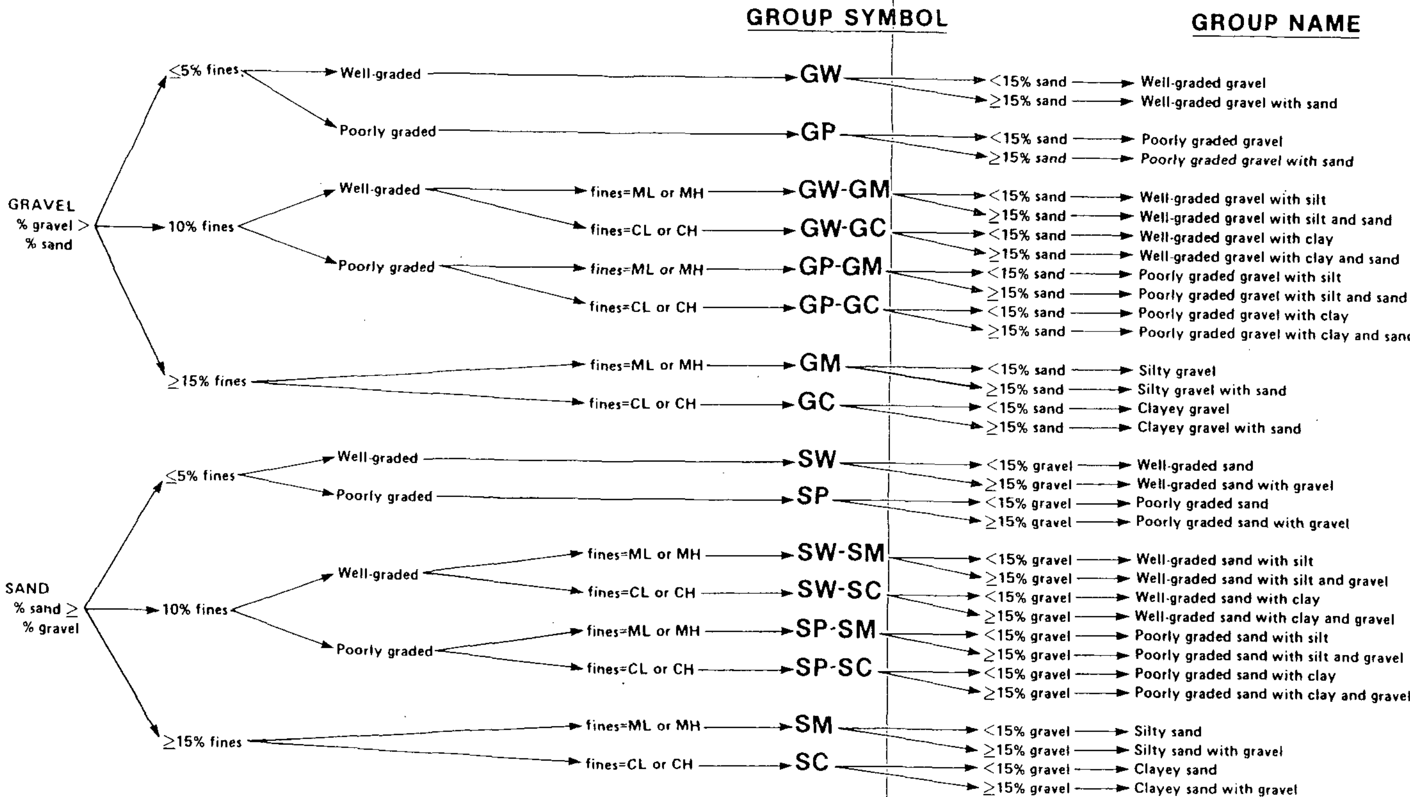
9.1 The sample shall be considered to be representative of the stratum from which it was obtained by an appropriate, accepted, or standard procedure.

NOTE 6—Preferably, the sampling procedure should be identified as having been conducted in accordance with Practices D 1452, D 1587, or D 2113, or Test Method D 1586.

9.2 The sample shall be carefully identified as to origin.

NOTE 7—Remarks as to the origin may take the form of a boring number and sample number in conjunction with a job number, a geologic stratum, a pedologic horizon or a location description with respect to a permanent monument, a grid system or a station number and offset with respect to a stated centerline and a depth or elevation.

9.3 For accurate description and identification, the minimum amount of the specimen to be examined shall be in accordance with the following schedule:




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)**

| Maximum Particle Size, Sieve Opening | Minimum Specimen Size, Dry Weight |
|---|---|
| 4.75 mm (No. 4) | 100 g (0.25 lb) |
| 9.5 mm (3/8 in.) | 200 g (0.5 lb) |
| 19.0 mm (3/4 in.) | 1.0 kg (2.2 lb) |
| 38.1 mm (1½ in.) | 8.0 kg (18 lb) |
| 75.0 mm (3 in.) | 60.0 kg (132 lb) |

NOTE 8—If random isolated particles are encountered that are significantly larger than the particles in the soil matrix, the soil matrix can be accurately described and identified in accordance with the preceeding schedule.

9.4 If the field sample or specimen being examined is smaller than the minimum recommended amount, the report shall include an appropriate remark.

## 10. Descriptive Information for Soils

10.1 *Angularity*—Describe the angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, subangular, subrounded, or rounded in accordance with the criteria in Table 1 and Fig. 3. A range of angularity may be stated, such as: subrounded to rounded.

10.2 *Shape*—Describe the shape of the gravel, cobbles, and boulders as flat, elongated, or flat and elongated if they meet the criteria in Table 2 and Fig. 4. Otherwise, do not mention the shape. Indicate the fraction of the particles that have the shape, such as: one-third of the gravel particles are flat.

10.3 *Color*—Describe the color. Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. If the sample contains layers or patches of varying colors, this shall be noted and all representative colors shall be described. The color shall be described for moist samples. If the color represents a dry condition, this shall be stated in the report.

**TABLE 1 Criteria for Describing Angularity of Coarse-Grained Particles (see Fig. 3)**

| Description | Criteria |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | Particles are similar to angular description but have rounded edges |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | Particles have smoothly curved sides and no edges |

10.4 *Odor*—Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum product, chemical, and the like), it shall be described.

10.5 *Moisture Condition*—Describe the moisture condition as dry, moist, or wet, in accordance with the criteria in Table 3.

10.6 *HCl Reaction*—Describe the reaction with HCl as none, weak, or strong, in accordance with the critera in Table 4. Since calcium carbonate is a common cementing agent, a report of its presence on the basis of the reaction with dilute hydrochloric acid is important.

10.7 *Consistency*—For intact fine-grained soil, describe the

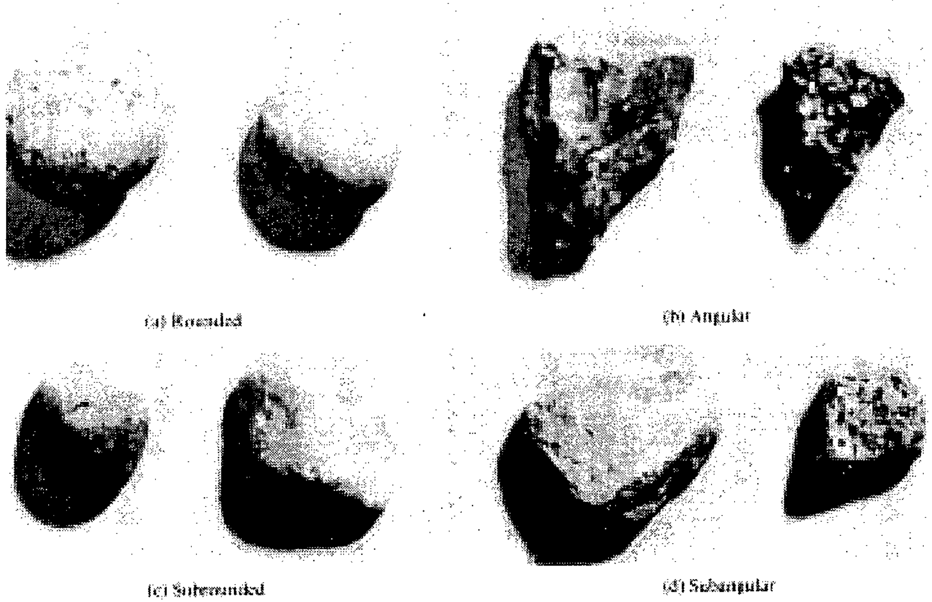



FIG. 3 Typical Angularity of Bulky Grains

TABLE 2 Criteria for Describing Particle Shape (see Fig. 4)

The particle shape shall be described as follows where length, width, and thickness refer to the greatest, intermediate, and least dimensions of a particle, respectively.

| | |
|---|---|
| Flat | Particles with width/thickness > 3 |
| Elongated | Particles with length/width > 3 |
| Flat and elongated | Particles meet criteria for both flat and elongated |

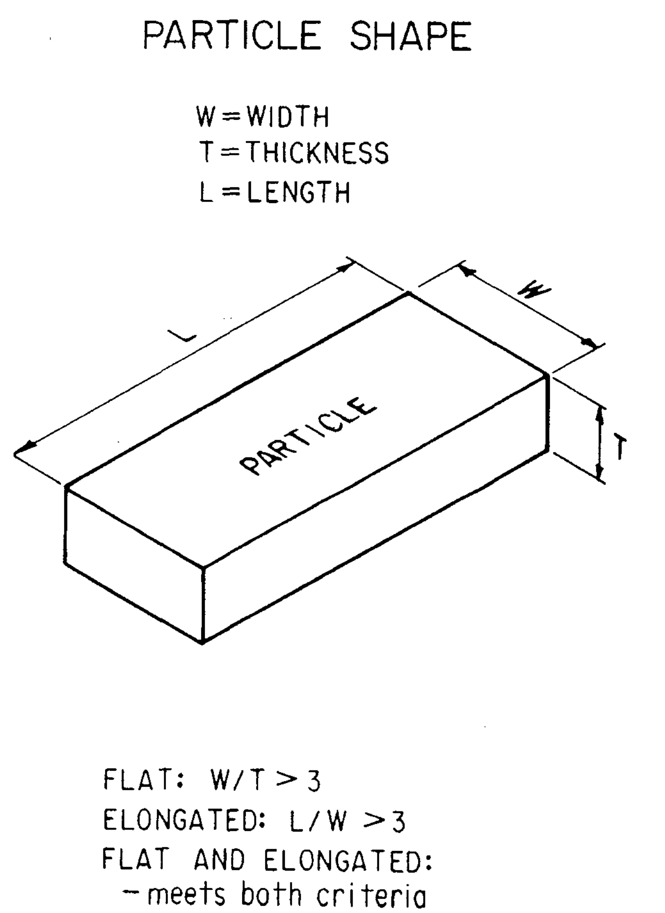



FIG. 4 Criteria for Particle Shape

consistency as very soft, soft, firm, hard, or very hard, in accordance with the criteria in Table 5. This observation is inappropriate for soils with significant amounts of gravel.

10.8 *Cementation*—Describe the cementation of intact coarse-grained soils as weak, moderate, or strong, in accordance with the criteria in Table 6.

10.9 *Structure*—Describe the structure of intact soils in accordance with the criteria in Table 7.

10.10 *Range of Particle Sizes*—For gravel and sand components, describe the range of particle sizes within each component as defined in 3.1.2 and 3.1.6. For example, about 20 % fine to coarse gravel, about 40 % fine to coarse sand.

10.11 *Maximum Particle Size*—Describe the maximum particle size found in the sample in accordance with the following information:

10.11.1 *Sand Size*—If the maximum particle size is a sand size, describe as fine, medium, or coarse as defined in 3.1.6. For example: maximum particle size, medium sand.

10.11.2 *Gravel Size*—If the maximum particle size is a gravel size, describe the maximum particle size as the smallest sieve opening that the particle will pass. For example, maximum particle size, 1½ in. (will pass a 1½-in. square opening but not a ¾-in. square opening).

10.11.3 *Cobble or Boulder Size*—If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle. For example: maximum dimension, 18 in. (450 mm).

10.12 *Hardness*—Describe the hardness of coarse sand and larger particles as hard, or state what happens when the

TABLE 3 Criteria for Describing Moisture Condition

| Description | Criteria |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually soil is below water table |

TABLE 4 Criteria for Describing the Reaction With HCl

| Description | Criteria |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |

TABLE 5 Criteria for Describing Consistency

| Description | Criteria |
|---|---|
| Very soft | Thumb will penetrate soil more than 1 in. (25 mm) |
| Soft | Thumb will penetrate soil about 1 in. (25 mm) |
| Firm | Thumb will indent soil about ¼in. (6 mm) |
| Hard | Thumb will not indent soil but readily indented with thumbnail |
| Very hard | Thumbnail will not indent soil |

TABLE 6 Criteria for Describing Cementation

| Description | Criteria |
|---|---|
| Weak | Crumbles or breaks with handling or little finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

TABLE 7 Criteria for Describing Structure

| Description | Criteria |
|---|---|
| Stratified | Alternating layers of varying material or color with layers at least 6 mm thick; note thickness |
| Laminated | Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness |
| Homogeneous | Same color and appearance throughout |

particles are hit by a hammer, for example, gravel-size particles fracture with considerable hammer blow, some gravel-size particles crumble with hammer blow. "Hard" means particles do not crack, fracture, or crumble under a hammer blow.

10.13 Additional comments shall be noted, such as the presence of roots or root holes, difficulty in drilling or augering hole, caving of trench or hole, or the presence of mica.

10.14 A local or commercial name or a geologic interpretation of the soil, or both, may be added if identified as such.

10.15 A classification or identification of the soil in accordance with other classification systems may be added if identified as such.

## 11. Identification of Peat

11.1 A sample composed primarily of vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as peat, PT, and not subjected to the identification procedures described hereafter.

## 12. Preparation for Identification

12.1 The soil identification portion of this practice is based on the portion of the soil sample that will pass a 3-in. (75-mm) sieve. The larger than 3-in. (75-mm) particles must be removed, manually, for a loose sample, or mentally, for an intact sample before classifying the soil.

12.2 Estimate and note the percentage of cobbles and the percentage of boulders. Performed visually, these estimates will be on the basis of volume percentage.

NOTE 9—Since the percentages of the particle-size distribution in Test Method D 2487 are by dry weight, and the estimates of percentages for gravel, sand, and fines in this practice are by dry weight, it is recommended that the report state that the percentages of cobbles and boulders are by volume.

12.3 Of the fraction of the soil smaller than 3 in. (75 mm), estimate and note the percentage, by dry weight, of the gravel, sand, and fines (see Appendix X4 for suggested procedures).

NOTE 10—Since the particle-size components appear visually on the basis of volume, considerable experience is required to estimate the percentages on the basis of dry weight. Frequent comparisons with laboratory particle-size analyses should be made.

12.3.1 The percentages shall be estimated to the closest 5 %. The percentages of gravel, sand, and fines must add up to 100 %.

12.3.2 If one of the components is present but not in sufficient quantity to be considered 5 % of the smaller than 3-in. (75-mm) portion, indicate its presence by the term *trace*, for example, trace of fines. A trace is not to be considered in the total of 100 % for the components.

## 13. Preliminary Identification

13.1 The soil is *fine grained* if it contains 50 % or more fines. Follow the procedures for identifying fine-grained soils of Section 14.

13.2 The soil is *coarse grained* if it contains less than 50 % fines. Follow the procedures for identifying coarse-grained soils of Section 15.

## 14. Procedure for Identifying Fine-Grained Soils

14.1 Select a representative sample of the material for examination. Remove particles larger than the No. 40 sieve (medium sand and larger) until a specimen equivalent to about a handful of material is available. Use this specimen for performing the dry strength, dilatancy, and toughness tests.

14.2 *Dry Strength*:

14.2.1 From the specimen, select enough material to mold into a ball about 1 in. (25 mm) in diameter. Mold the material until it has the consistency of putty, adding water if necessary.

14.2.2 From the molded material, make at least three test specimens. A test specimen shall be a ball of material about ½ in. (12 mm) in diameter. Allow the test specimens to dry in air, or sun, or by artificial means, as long as the temperature does not exceed 60°C.

14.2.3 If the test specimen contains natural dry lumps, those that are about ½ in. (12 mm) in diameter may be used in place of the molded balls.

NOTE 11—The process of molding and drying usually produces higher strengths than are found in natural dry lumps of soil.

14.2.4 Test the strength of the dry balls or lumps by crushing between the fingers. Note the strength as none, low, medium, high, or very high in accorance with the criteria in Table 8. If natural dry lumps are used, do not use the results of any of the lumps that are found to contain particles of coarse sand.

14.2.5 The presence of high-strength water-soluble cementing materials, such as calcium carbonate, may cause exceptionally high dry strengths. The presence of calcium carbonate can usually be detected from the intensity of the reaction with dilute hydrochloric acid (see 10.6).

14.3 *Dilatancy*:

14.3.1 From the specimen, select enough material to mold into a ball about ½ in. (12 mm) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency.

14.3.2 Smooth the soil ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 9. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

14.4 *Toughness*:

14.4.1 Following the completion of the dilatancy test, the test specimen is shaped into an elongated pat and rolled by hand on a smooth surface or between the palms into a thread about ⅛ in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about ⅛ in. The thread will crumble at a diameter of ⅛ in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading.

14.4.2 Describe the toughness of the thread and lump as low, medium, or high in accordance with the criteria in Table 10.

14.5 *Plasticity*—On the basis of observations made during the toughness test, describe the plasticity of the material in accordance with the criteria given in Table 11.

14.6 Decide whether the soil is an *inorganic* or an *organic* fine-grained soil (see 14.8). If inorganic, follow the steps given in 14.7.

14.7 *Identification of Inorganic Fine-Grained Soils*:

14.7.1 Identify the soil as a *lean clay*, CL, if the soil has medium to high dry strength, no or slow dilatancy, and medium toughness and plasticity (see Table 12).

14.7.2 Identify the soil as a *fat clay*, CH, if the soil has high to very high dry strength, no dilatancy, and high toughness and plasticity (see Table 12).

14.7.3 Identify the soil as a *silt*, ML, if the soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic (see Table 12).

14.7.4 Identify the soil as an *elastic silt*, MH, if the soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity (see Table 12).

NOTE 12—These properties are similar to those for a lean clay. However, the silt will dry quickly on the hand and have a smooth, silky feel when dry. Some soils that would classify as MH in accordance with the criteria in Test Method D 2487 are visually difficult to distinguish from lean clays, CL. It may be necessary to perform laboratory testing for proper identification.

14.8 *Identification of Organic Fine-Grained Soils*:

14.8.1 Identify the soil as an *organic soil*, OL/OH, if the soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air dried. Organic soils normally will not have a high toughness or plasticity. The thread for the toughness test will be spongy.

NOTE 13—In some cases, through practice and experience, it may be possible to further identify the organic soils as organic silts or organic clays, OL or OH. Correlations between the dilatancy, dry strength, toughness tests, and laboratory tests can be made to identify organic soils in certain deposits of similar materials of known geologic origin.

**TABLE 8 Criteria for Describing Dry Strength**

| Description | Criteria |
|---|---|
| None | The dry specimen crumbles into powder with mere pressure of handling |
| Low | The dry specimen crumbles into powder with some finger pressure |
| Medium | The dry specimen breaks into pieces or crumbles with considerable finger pressure |
| High | The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface |
| Very high | The dry specimen cannot be broken between the thumb and a hard surface |

**TABLE 9 Criteria for Describing Dilatancy**

| Description | Criteria |
|---|---|
| None | No visible change in the specimen |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing |

**TABLE 10 Criteria for Describing Toughness**

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft |
| Medium | Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness |
| High | Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness |

TABLE 11 Criteria for Describing Plasticity

| Description | Criteria |
|---|---|
| Nonplastic | A ⅛-in. (3-mm) thread cannot be rolled at any water content |
| Low | The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit |
| Medium | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit |
| High | It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit |

TABLE 12 Identification of Inorganic Fine-Grained Soils from Manual Tests

| Soil Symbol | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|
| ML | None to low | Slow to rapid | Low or thread cannot be formed |
| CL | Medium to high | None to slow | Medium |
| MH | Low to medium | None to slow | Low to medium |
| CH | High to very high | None | High |

14.9 If the soil is estimated to have 15 to 25 % sand or gravel, or both, the words "with sand" or "with gravel" (whichever is more predominant) shall be added to the group name. For example: "lean clay with sand, CL" or "silt with gravel, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percentage of gravel, use "with sand."

14.10 If the soil is estimated to have 30 % or more sand or gravel, or both, the words "sandy" or "gravelly" shall be added to the group name. Add the word "sandy" if there appears to be more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy lean clay, CL", "gravelly fat clay, CH", or "sandy silt, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percent of gravel, use "sandy."

## 15. Procedure for Identifying Coarse-Grained Soils

(Contains less than 50 % fines)

15.1 The soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand.

15.2 The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

15.3 The soil is a *clean gravel* or *clean sand* if the percentage of fines is estimated to be 5 % or less.

15.3.1 Identify the soil as a *well-graded gravel*, GW, or as a *well-graded sand*, SW, if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes.

15.3.2 Identify the soil as a *poorly graded gravel*, GP, or as a *poorly graded sand*, SP, if it consists predominantly of one size (uniformly graded), or it has a wide range of sizes with some intermediate sizes obviously missing (gap or skip graded).

15.4 The soil is either a *gravel with fines* or a *sand with fines* if the percentage of fines is estimated to be 15 % or more.

15.4.1 Identify the soil as a *clayey gravel*, GC, or a *clayey sand*, SC, if the fines are clayey as determined by the procedures in Section 14.

15.4.2 Identify the soil as a *silty gravel*, GM, or a *silty sand*, SM, if the fines are silty as determined by the procedures in Section 14.

15.5 If the soil is estimated to contain 10 % fines, give the soil a dual identification using two group symbols.

15.5.1 The first group symbol shall correspond to a clean gravel or sand (GW, GP, SW, SP) and the second symbol shall correspond to a gravel or sand with fines (GC, GM, SC, SM).

15.5.2 The group name shall correspond to the first group symbol plus the words "with clay" or "with silt" to indicate the plasticity characteristics of the fines. For example: "well-graded gravel with clay, GW-GC" or "poorly graded sand with silt, SP-SM" (see Fig. 2).

15.6 If the specimen is predominantly sand or gravel but contains an estimated 15 % or more of the other coarse-grained constituent, the words "with gravel" or "with sand" shall be added to the group name. For example: "poorly graded gravel with sand, GP" or "clayey sand with gravel, SC" (see Fig. 2).

15.7 If the field sample contains any cobbles or boulders, or both, the words "with cobbles" or "with cobbles and boulders" shall be added to the group name. For example: "silty gravel with cobbles, GM."

## 16. Report

16.1 The report shall include the information as to origin, and the items indicated in Table 13.

NOTE 14—*Example: Clayey Gravel with Sand and Cobbles, GC*—About 50 % fine to coarse, subrounded to subangular gravel; about 30 % fine to coarse, subrounded sand; about 20 % fines with medium plasticity, high dry strength, no dilatancy, medium toughness; weak reaction with HCl; original field sample had about 5 % (by volume) subrounded cobbles, maximum dimension, 150 mm.

In-Place Conditions—Firm, homogeneous, dry, brown

Geologic Interpretation—Alluvial fan

TABLE 13 Checklist for Description of Soils

1. Group name
2. Group symbol
3. Percent of cobbles or boulders, or both (by volume)
4. Percent of gravel, sand, or fines, or all three (by dry weight)
5. Particle-size range:
   Gravel—fine, coarse
   Sand—fine, medium, coarse
6. Particle angularity: angular, subangular, subrounded, rounded
7. Particle shape: (if appropriate) flat, elongated, flat and elongated
8. Maximum particle size or dimension
9. Hardness of coarse sand and larger particles
10. Plasticity of fines: nonplastic, low, medium, high
11. Dry strength: none, low, medium, high, very high
12. Dilatancy: none, slow, rapid
13. Toughness: low, medium, high
14. Color (in moist condition)
15. Odor (mention only if organic or unusual)
16. Moisture: dry, moist, wet
17. Reaction with HCl: none, weak, strong

*For intact samples:*

18. Consistency (fine-grained soils only): very soft, soft, firm, hard, very hard
19. Structure: stratified, laminated, fissured, slickensided, lensed, homogeneous
20. Cementation: weak, moderate, strong
21. Local name
22. Geologic interpretation
23. Additional comments: presence of roots or root holes, presence of mica, gypsum, etc., surface coatings on coarse-grained particles, caving or sloughing of auger hole or trench sides, difficulty in augering or excavating, etc.

NOTE 15—Other examples of soil descriptions and identification are given in Appendix X1 and Appendix X2.

NOTE 16—If desired, the percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages, as follows:

*Trace*—Particles are present but estimated to be less than 5 %
*Few*—5 to 10 %
*Little*—15 to 25 %
*Some*—30 to 45 %
*Mostly*—50 to 100 %

16.2 If, in the soil description, the soil is identified using a classification group symbol and name as described in Test Method D 2487, it must be distinctly and clearly stated in log forms, summary tables, reports, and the like, that the symbol and name are based on visual-manual procedures.

## 17. Precision and Bias

17.1 This practice provides qualitative information only, therefore, a precision and bias statement is not applicable.

## 18. Keywords

18.1 classification; clay; gravel; organic soils; sand; silt; soil classification; soil description; visual classification

# APPENDIXES

**(Nonmandatory Information)**

## X1. EXAMPLES OF VISUAL SOIL DESCRIPTIONS

X1.1 The following examples show how the information required in 16.1 can be reported. The information that is included in descriptions should be based on individual circumstances and need.

X1.1.1 *Well-Graded Gravel with Sand (GW)*—About 75 % fine to coarse, hard, subangular gravel; about 25 % fine to coarse, hard, subangular sand; trace of fines; maximum size, 75 mm, brown, dry; no reaction with HCl.

X1.1.2 *Silty Sand with Gravel (SM)*—About 60 % predominantly fine sand; about 25 % silty fines with low plasticity, low dry strength, rapid dilatancy, and low toughness; about 15 % fine, hard, subrounded gravel, a few gravel-size particles fractured with hammer blow; maximum size, 25 mm; no reaction with HCl (Note—Field sample size smaller than recommended).

*In-Place Conditions*—Firm, stratified and contains lenses of silt 1 to 2 in. (25 to 50 mm) thick, moist, brown to gray; in-place density 106 lb/ft$^3$; in-place moisture 9 %.

X1.1.3 *Organic Soil (OL/OH)*—About 100 % fines with low plasticity, slow dilatancy, low dry strength, and low toughness; wet, dark brown, organic odor; weak reaction with HCl.

X1.1.4 *Silty Sand with Organic Fines (SM)*—About 75 % fine to coarse, hard, subangular reddish sand; about 25 % organic and silty dark brown nonplastic fines with no dry strength and slow dilatancy; wet; maximum size, coarse sand; weak reaction with HCl.

X1.1.5 *Poorly Graded Gravel with Silt, Sand, Cobbles and Boulders (GP-GM)*—About 75 % fine to coarse, hard, subrounded to subangular gravel; about 15 % fine, hard, subrounded to subangular sand; about 10 % silty nonplastic fines; moist, brown; no reaction with HCl; original field sample had about 5 % (by volume) hard, subrounded cobbles and a trace of hard, subrounded boulders, with a maximum dimension of 18 in. (450 mm).

## X2. USING THE IDENTIFICATION PROCEDURE AS A DESCRIPTIVE SYSTEM FOR SHALE, CLAYSTONE, SHELLS, SLAG, CRUSHED ROCK, AND THE LIKE

X2.1 The identification procedure may be used as a descriptive system applied to materials that exist in-situ as shale, claystone, sandstone, siltstone, mudstone, etc., but convert to soils after field or laboratory processing (crushing, slaking, and the like).

X2.2 Materials such as shells, crushed rock, slag, and the like, should be identified as such. However, the procedures used in this practice for describing the particle size and plasticity characteristics may be used in the description of the material. If desired, an identification using a group name and symbol according to this practice may be assigned to aid in describing the material.

X2.3 The group symbol(s) and group names should be placed in quotation marks or noted with some type of distinguishing symbol. See examples.

X2.4 Examples of how group names and symbols can be incororated into a descriptive system for materials that are not naturally occurring soils are as follows:

X2.4.1 *Shale Chunks*—Retrieved as 2 to 4-in. (50 to 100-mm) pieces of shale from power auger hole, dry, brown, no reaction with HCl. After slaking in water for 24 h, material identified as "Sandy Lean Clay (CL)"; about 60 % fines with medium plasticity, high dry strength, no dilatancy, and medium toughness; about 35 % fine to medium, hard sand; about 5 % gravel-size pieces of shale.

X2.4.2 *Crushed Sandstone*—Product of commercial crushing operation; "Poorly Graded Sand with Silt (SP-SM)"; about 90 % fine to medium sand; about 10 % nonplastic fines; dry, reddish-brown, strong reaction with HCl.

X2.4.3 *Broken Shells*—About 60 % gravel-size broken shells; about 30 % sand and sand-size shell pieces; about 10 % fines; "Poorly Graded Gravel with Sand (GP)."

X2.4.4 *Crushed Rock*—Processed from gravel and cobbles in Pit No. 7; "Poorly Graded Gravel (GP)"; about 90 % fine, hard, angular gravel-size particles; about 10 % coarse, hard, angular sand-size particles; dry, tan; no reaction with HCl.

## X3. SUGGESTED PROCEDURE FOR USING A BORDERLINE SYMBOL FOR SOILS WITH TWO POSSIBLE IDENTIFICATIONS.

X3.1 Since this practice is based on estimates of particle size distribution and plasticity characteristics, it may be difficult to clearly identify the soil as belonging to one category. To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols *separated by a slash. For example: SC/CL or CL/CH.*

X3.1.1 A borderline symbol may be used when the percentage of fines is estimated to be between 45 and 55 %. One symbol should be for a coarse-grained soil with fines and the other for a fine-grained soil. For example: GM/ML or CL/SC.

X3.1.2 A borderline symbol may be used when the percentage of sand and the percentage of gravel are estimated to be about the same. For example: GP/SP, SC/GC, GM/SM. It is practically impossible to have a soil that would have a borderline symbol of GW/SW.

X3.1.3 A borderline symbol may be used when the soil could be either well graded or poorly graded. For example: GW/GP, SW/SP.

X3.1.4 A borderline symbol may be used when the soil could either be a silt or a clay. For example: CL/ML, CH/MH, SC/SM.

X3.1.5 A borderline symbol may be used when a fine-grained soil has properties that indicate that it is at the boundary between a soil of low compressibility and a soil of high compressibility. For example: CL/CH, MH/ML.

X3.2 *The order of the borderline symbols should reflect* similarity to surrounding or adjacent soils. For example: soils in a borrow area have been identified as CH. One sample is considered to have a borderline symbol of CL and CH. To show similarity, the borderline symbol should be CH/CL.

X3.3 The group name for a soil with a borderline symbol should be the group name for the first symbol, except for:

CL/CH lean to fat clay
ML/CL clayey silt
CL/ML silty clay

X3.4 The use of a borderline symbol should not be used indiscriminately. Every effort shall be made to first place the soil into a single group.

## X4. SUGGESTED PROCEDURES FOR ESTIMATING THE PERCENTAGES OF GRAVEL, SAND, AND FINES IN A SOIL SAMPLE

X4.1 *Jar Method*—The relative percentage of coarse- and fine-grained material may be estimated by thoroughly shaking a mixture of soil and water in a test tube or jar, and then allowing the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 s. The relative proportions can be estimated from the relative volume of each size separate. This method should be correlated to particle-size laboratory determinations.

X4.2 *Visual Method*—Mentally visualize the gravel size particles placed in a sack (or other container) or sacks. Then, do the same with the sand size particles and the fines. Then, mentally compare the number of sacks to estimate the percentage of plus No. 4 sieve size and minus No. 4 sieve size present. The percentages of sand and fines in the minus sieve size No. 4 material can then be estimated from the wash test (X4.3).

X4.3 *Wash Test (for relative percentages of sand and fines)*—Select and moisten enough minus No. 4 sieve size material to form a 1-in (25-mm) cube of soil. Cut the cube in half, set one-half to the side, and place the other half in a small dish. Wash and decant the fines out of the material in the dish until the wash water is clear and then compare the two samples and estimate the percentage of sand and fines. Remember that the percentage is based on weight, not volume. However, the volume comparison will provide a reasonable indication of grain size percentages.

X4.3.1 While washing, it may be necessary to break down lumps of fines with the finger to get the correct percentages.

## X5. ABBREVIATED SOIL CLASSIFICATION SYMBOLS

X5.1 In some cases, because of lack of space, an abbreviated system may be useful to indicate the soil classification symbol and name. Examples of such cases would be graphical logs, databases, tables, etc.

X5.2 This abbreviated system is not a substitute for the full name and descriptive information but can be used in supplementary presentations when the complete description is referenced.

X5.3 The abbreviated system should consist of the soil classification symbol based on this standard with appropriate lower case letter prefixes and suffixes as:

| *Prefix:* | Suffix: |
|---|---|
| s = sandy | s = with sand |
| g = gravelly | g = with gravel |
| | c = with cobbles |
| | b = with boulders |

X5.4 The soil classification symbol is to be enclosed in parenthesis. Some examples would be:

| *Group Symbol and Full Name* | Abbreviated |
|---|---|
| CL, Sandy lean clay | s(CL) |
| SP-SM, Poorly graded sand with silt and gravel | (SP-SM)g |
| GP, poorly graded gravel with sand, cobbles, and boulders | (GP)scb |
| ML, gravelly silt with sand and cobbles | g(ML)sc |

## SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the last edition ($1993^{\epsilon 1}$) that may impact the use of this standard.

(1) Added Practice D 3740 to Section 2.

(2) Added Note 5 under 5.7 and renumbered subsequent notes.

# STANDARD OPERATING PROCEDURE SL-07

# SUBSURFACE SOIL SAMPLING

integral consulting inc.

# STANDARD OPERATING PROCEDURE (SOP) SL-07

# SUBSURFACE SOIL SAMPLING

## SCOPE AND APPLICATION

The following procedures are designed to be used to collect subsurface soil samples using a hand auger, direct-push drill rig, and a backhoe. *All underground utilities must be located and cleared prior to drilling or excavating.* Soil samples should be collected from areas having lower levels of constituents of interest first, followed by stations with higher expected levels of constituents of interest.

Based on field and site conditions, the procedures listed below may be modified in the field upon agreement of the field team leader and project management, after appropriate annotations have been made in the project-specific field logbook. If specialized sampling methods (e.g., Encore®) are to be used, refer to the manufacturer's recommended procedures. If methanol preservation is required, refer to Integral SOP SL-08 on methanol preservation of soil samples. Record all pertinent information in the Integral field logbook, subsurface soil field collection form, or boring log (as appropriate).

## EQUIPMENT AND SUPPLIES REQUIRED

- Subsurface sampling equipment (e.g., hand auger, direct-push drill rig [e.g., Geoprobe®], backhoe, stainless-steel spade) (consult project-specific field sampling plan [FSP] for kind of equipment to be used for a specific field event)
- Large stainless steel mixing bowl and spoon
- Laboratory-supplied sample containers, insulated coolers, and ice
- Chain-of-custody forms, custody seals, sample labels
- Resealable plastic bags (e.g., Ziploc®)
- Camera
- Tape measure
- Logging table
- 6-mil visqueen and duct tape for covering the logging table
- Aluminum foil

- 55-gallon drums for decontamination waters and excess soil (separate drums for liquid and solid wastes) if required by the project-specific FSP
- Field logbook, subsurface soil field collection form, and/or soil boring form, and pens
- Project-specific FSP and health and safety plan (HSP)
- Personal protective equipment (PPE) (safety glasses, steel-toed boots, nitrile gloves, and any other items required by the project-specific HSP)
- Photoionization detector (PID), if required by the project-specific FSP or HSP
- Global positioning system (GPS), if required by the project-specific FSP
- Decontamination equipment.

## HAND AUGER SAMPLER

The following procedures are designed to be used during the general operation of a hand auger sampler. The procedures listed below may be modified in the field upon agreement of the field team leader and drill operators, based on field and site conditions, after appropriate annotations have been made in the field logbook.

1. Locate the sample station as directed in the project-specific FSP. Place sample labels on the sample container prior to filling in accordance with Integral's SOP on sample labeling (SOP AP-04).
2. Place plastic sheeting adjacent to the sampling location.
3. Advance the hand auger into subsurface soil.
4. Empty soil from the first interval (as specified in the project-specific FSP) from the hand auger into a decontaminated stainless steel bowl and cover the bowl with aluminum foil. Continue advancing the hand auger until the next appropriate sample interval has been completed.
5. Screen the soil sample for volatile organic compounds (VOCs) using a PID if required by the project-specific FSP.
6. Photograph each interval with depth and site markers visible in the photograph, if applicable.
7. Log the soils in accordance with SOP SL-04 (*Field Classification of Soils*).
8. If VOC samples are required (see project-specific FSP), collect them prior to homogenizing (i.e., mixing) the sample. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and sealing it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.

9. (a) If the soil sample is to be a discrete sample (see project-specific FSP), collect soil from the hand auger using a decontaminated stainless-steel spoon and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.

   (b) If additional sample volume is required to perform the analyses specified in the project-specific FSP, place multiple soil samples collected from nearby locations (it is important to keep the distance between multiple soil borings as close as possible; the maximum distance will be specified in the project-specific FSP) from the same depth interval into a composite sample in a single decontaminated stainless-steel bowl. When a sufficient volume of soil has been obtained, homogenize all of the soil in the bowl to a consistent color and texture using a decontaminated spoon.

10. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.

11. Remove samples of the homogenized soil from the compositing bowl and place in the appropriate size sample container. Fill the sample container with soil to just below the container lip, and seal the container tightly.

12. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.

13. Repeat the process described above for all subsequent sample intervals.

14. Complete the appropriate field books, field data sheets, and quality assurance and quality control (QA/QC) documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.

15. Backfill the borehole with remaining hand auger soil cuttings or place the cuttings in a properly labeled 55-gallon drum, as specified in the project-specific FSP. If soil cuttings are placed in a 55-gallon drum, backfill the borehole with bentonite hole plug pellets and hydrate the pellets with potable water.

16. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP.

## DIRECT-PUSH DRILL RIG

The following procedures are designed to be used during the general operation of direct-push drill rig (e.g., Geoprobe®). The procedures listed below may be modified in the field upon agreement of the field team leader and drill operators, based on field and site conditions, after appropriate annotations have been made in the field logbook. The direct-push drill rig will be operated by a licensed drilling contractor.

The direct-push drilling technique hydraulically pushes tools into the ground to collect soil samples. Direct-push drilling techniques can be used to collect soil samples to depths of 30–100 ft, depending on drilling conditions at the site. In addition to soil sample collection, direct-push techniques can be used to collect soil gas samples, reconnoiter groundwater samples, and install small-diameter monitoring wells.

Soil samples can be collected using two types of Macrocore® samplers, open tip and closed tip. These samplers are typically either 4 ft long by 1.5 in. inside diameter (i.d.) or 5 ft long by 2.5 in. i.d. These samplers have a tubular design and utilize acetate liners to collect the soil samples. The following sections of this SOP describe how to collect soil samples using open-tip and closed-tip Macrocore® samplers.

## Open-Tip Sampler

The open-tip sampler is typically used in soils that are cohesive (e.g., stiff silts and clays), where the soil boring is stable and stays open when the sampler and rods are removed from the ground.

1. Ensure all underground utilities are cleared prior to initiating drilling activities.
2. Position the direct-push drill rig over the sample station and remove any surface material that will interfere with sampling. Note in the field logbook any surface material that is removed prior to sampling.
3. Determine the interval to be sampled and install a new clean liner into the open tip Macrocore® sampler.
4. Push the sampler to the bottom of the appropriate sample interval.
5. Retract the rods and Macrocore® sampler.
6. After the Macrocore® sampler has been brought to the surface, remove the liner from the sampler, cap both ends of the liner, and inspect it.
7. After the soil sample is judged to be acceptable, label the sample liner with the station identifier, depth interval, and soil orientation (i.e., arrow pointing toward uppermost soil interval).
8. Place the capped sample liner on a new piece of aluminum foil on the logging table and split the liner open with a hook or utility knife. Process the sample in accordance with the "General Sampling Procedures" listed below.
9. Repeat Steps 2–8 for each subsequent sample interval.

## Closed-Tip Sampler

The closed-tip sampler is typically used to collect soil samples that are noncohesive (e.g., sandy materials), where the soil boring is unstable and collapses when the rods and sampler are removed from the ground.

1. Ensure all underground utilities are cleared prior to initiating drilling activities.
2. Position the direct-push drill rig over the sample station and remove any surface material that will interfere with sampling. Note in the field logbook any surface material removed prior to sampling.
3. Determine the interval to be sampled and install a drive point and a new clean liner into the closed-tip Macrocore® sampler.
4. Push the rods and sampler to the top of the appropriate sample interval.
5. Retract the rods to release the drive point.
6. Push the sampler to the bottom of the appropriate sample interval.
7. Retract the rods and Macrocore® sampler.
8. Once the soil sample has been brought to the surface, remove the liner from the sampler, cap both ends of the liner, and inspect it.
9. After the soil sample is judged to be acceptable, label the sample liner with the station identifier, depth interval, and soil orientation (i.e., arrow pointing toward uppermost soil interval).
10. Place the capped sample liner on a new piece of aluminum foil on the logging table and split the liner open with a hook or utility knife. Process the sample in accordance with the "General Sampling Procedures" listed below.
11. Repeat Steps 2–10 for each additional sample interval.

## General Sampling Procedures

1. After the liner has been split open, screen the soil sample for VOCs using a PID if required by the project-specific FSP.
2. Log the soils in accordance with SOP SL-04 (*Field Classification of Soils*).
3. Photograph each section of the soil boring with appropriate orientation, depth, and site markers visible in the photograph, if specified in the project-specific FSP.

4. If VOC samples are required (see project-specific FSP), collect them prior to sample removal from the liner. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and seal it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.

5. Remove the soil from the liner using a decontaminated stainless-steel spoon and place the soil in a decontaminated compositing bowl and thoroughly mix and homogenize the sample using a decontaminated spoon until the color and texture are consistent throughout.

6. (a) If the soil sample is to be a discrete sample (see project-specific FSP), collect soil from the liner using a decontaminated stainless-steel spoon and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.

   (b) If additional sample volume is required to perform the analyses specified in the project-specific FSP, place multiple soil samples collected from nearby locations (it is important to keep the distance between multiple soil borings as close as possible; the maximum distance will be specified in the project-specific FSP) from the same depth interval into a composite sample in a single decontaminated stainless-steel bowl. When a sufficient volume of soil has been obtained, homogenize all of the soil in the bowl to a consistent color and texture using a decontaminated spoon.

7. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.

8. Remove samples of the homogenized soil from the compositing bowl and place in the appropriate size sample container. Fill the sample container with soil to just below the container lip, and seal the container tightly.

9. Repeat the process described above for subsequent sample intervals.

10. Complete the appropriate field books, field data sheets, and QA/QC documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.

11. Backfill the borehole with remaining direct-push sampler cuttings or place the cuttings in a properly labeled 55-gallon drum, as specified in the project-specific FSP. If soil cuttings are placed in a 55-gallon drum, backfill the borehole with bentonite grout (mixed to the manufacturer's specifications) or bentonite hole plug pellets and hydrate the pellets with potable water.

12. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP.

13. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.

## Test Pit Excavations

The following procedures are to be used during the excavation of pits with construction equipment (i.e., backhoe or track-hoe) prior to soil sampling operations. Adhere to all requirements of the site-specific HSP for this specific activity. The procedures listed below may be modified in the field upon agreement of the field team leader and project management, based on field and site conditions, after appropriate annotations have been made in the field logbook.

1. Locate the sample station as directed in the project-specific FSP. Ensure all underground utilities have been cleared prior to initiating excavation activities. Place sample labels on all sample containers prior to filling in accordance with Integral's SOP for sample labeling (SOP AP-04).

2. Select the appropriate orientation for the excavation, basing it on the judgment of the field team leader, backhoe operator, and onsite conditions. Sampling personnel **MUST** remain in visual contact with the backhoe operator at all times, and out of possible "pinch zones" or areas where heavy equipment may move or swing.

3. Place plastic sheeting from the edge of the proposed excavation leading away for a sufficient distance to the proposed temporary stockpile location so that the excavated soil does not slough back into the pit.

4. Begin pit excavation.

5. Continue excavation of the pit to the required depth. If pit entry is necessary, this depth will not exceed 4 ft from the ground surface. Never enter a trench or pit if conditions are unstable. Excavate the proper pit exit trenches, shoring, and sloping to prevent accidental burial of sampling crew, and to meet or exceed all OSHA Construction Standards (29 CFR § 1926; Attachment 201-2) for entrance by sampling personnel. If pit entry is not necessary for sampling activities, pit depth can exceed 4 ft below ground surface. Instruct the backhoe operator to scrape material evenly along an exposed face to collect (to the extent practicable) a representative sample of the soils across the entire face in the bucket. Collect soil samples from the middle of the backhoe bucket.

6. Screen the soil sample for VOCs using a PID if required by the project-specific FSP.

7. Photograph each interval with depth and site markers visible in the photograph, if applicable.

8. Log the test pit soils in accordance with SOP SL-04 (*Field Classification of Soils*).

9. If VOC samples are required (see project-specific FSP), collect them prior to homogenizing (i.e., mixing) the sample. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and seal it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.

10. Collect soil using a decontaminated stainless-steel spoon or disposable sampling tool (depending on project-specific requirements; see FSP), which has been evenly removed from the face of the trench wall or from the bucket, and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.

11. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.

12. Remove samples of the homogenized soil from the compositing bowl and place them in the appropriate size sample container. Fill the sample container with soil to just below the container lip and seal it tightly.

13. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.

14. Repeat the process described above for all subsequent sample intervals.

15. Complete all pertinent field logbooks, field data sheets, and QA/QC documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.

16. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP. Photograph sample location and document in the logbook.

17. Backfill the test pit with the excavated soils. Depending on historical site data (see project-specific FSP), the plastic sheeting will either be disposed of as garbage or it will be drummed and sent to a hazardous waste landfill.

# ATTACHMENT A2
# ADDENDUM 4 TO THE OVERALL HEALTH AND SAFETY PLAN: SOIL SAMPLING HEALTH AND SAFETY PLAN

**Prepared for**

International Paper Company

**Prepared by**

Integral Consulting Inc.

411 First Avenue South, Suite 550

Seattle, Washington 98104

**December 2010**

## CERTIFICATION PAGE

Addendum 4 to the overall health and safety plan (HASP; Anchor QEA 2009) for the San Jacinto River Waste Pits Superfund Site (the Site) has been reviewed and approved by Integral Consulting Inc. (Integral) for the 2010 soil study at the Site in support of the remedial investigation and feasibility study (RI/FS) for the Site.

| | |
|---|---|
| Jennifer Sampson<br>Project Manager<br>Integral Consulting Inc. | Bill Lawrence<br>Field Lead<br>Integral Consulting Inc. |
| Date: ______________ | Date: ______________ |

# HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

Project Name: San Jacinto River Waste Pits Superfund Site

Addendum 4 to the overall HASP (Anchor QEA 2009) is approved by Integral for use at the San Jacinto River Waste Pits Superfund Site (the Site). The overall HASP and Addendum 4 are the minimum health and safety standard for the Site and will be strictly enforced for Integral personnel and other consulting personnel including subcontractors where applicable.

I have reviewed Addendum 4, dated December 2010, to the overall HASP for the 2010 soil study. I have had an opportunity to ask any questions I may have and have been provided with satisfactory responses. I understand the purpose of the plan, and I consent to adhere to its policies, procedures, and guidelines while an employee of Integral, or its subcontractors.

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# SITE EMERGENCY PROCEDURES

## Emergency Contact Information

**Table A**

**Site Emergency Form and Emergency Phone Numbers**

| **Category** | **Information** | |
|---|---|---|
| Chemicals of Potential Concern | Dioxins/furans, aluminum, magnesium, mercury, and copper | |
| Minimum Level of Protection | Level D | |
| Site(s) Location Address | (No formal address, see Figure A)<br>Channelview, TX 77530<br>Coordinates [29° 47′ 38.49″N, 95° 3′ 49.55″W] | |
| **Emergency Phone Numbers** | | |
| Ambulance | 911 | |
| Fire | 911 | |
| Police | 911 | |
| Poison Control | 911 and then 1-800-222-1212 if appropriate | |
| **Project-Specific Health and Safety Officers' Phone Numbers** | | |
| Integral Field Lead (FL) and Integral Site Safety Officer (SSO) | Bill Lawrence | Office: (206) 230-9600<br>Cell: (253) 691-2216 |
| Integral Corporate Health and Safety Manager (CHSM) | Eron Dodak | Office: (503) 284-5545 ext. 14<br>Cell: (503) 407-2933 |
| Integral Project Manager (PM) | Jennifer Sampson | Office: (206) 957-0351<br>Cell: (360) 286-7552 |
| Anchor QEA PM | David Keith | Office: (228) 818-9626<br>Cell: (228) 224-2983 |
| Anchor QEA FL and SSO | Chris Torell | Office: (315) 453-9009 ext. 17<br>Cell: (315) 254-4954 |
| Anchor QEA CHSM | David Templeton | Office: (206) 287-9130<br>Cell: (206) 910-4279 |
| Client Contract – International Paper Company (IPC) | Phil Slowiak | Office: (901) 419-3845<br>Cell: (901) 214-9550 |
| **Reporting Oil and Chemical Spills** | | |
| National Response Center | 1-800-424-8802 | |
| State Emergency Response System | (512) 424-2138 | |
| EPA Environmental Response Team | (201) 321-6600 | |

Note: In the event of any emergency, contact both the Integral and Anchor QEA PMs and FLs.

**Figure A**

**Site Location Map**

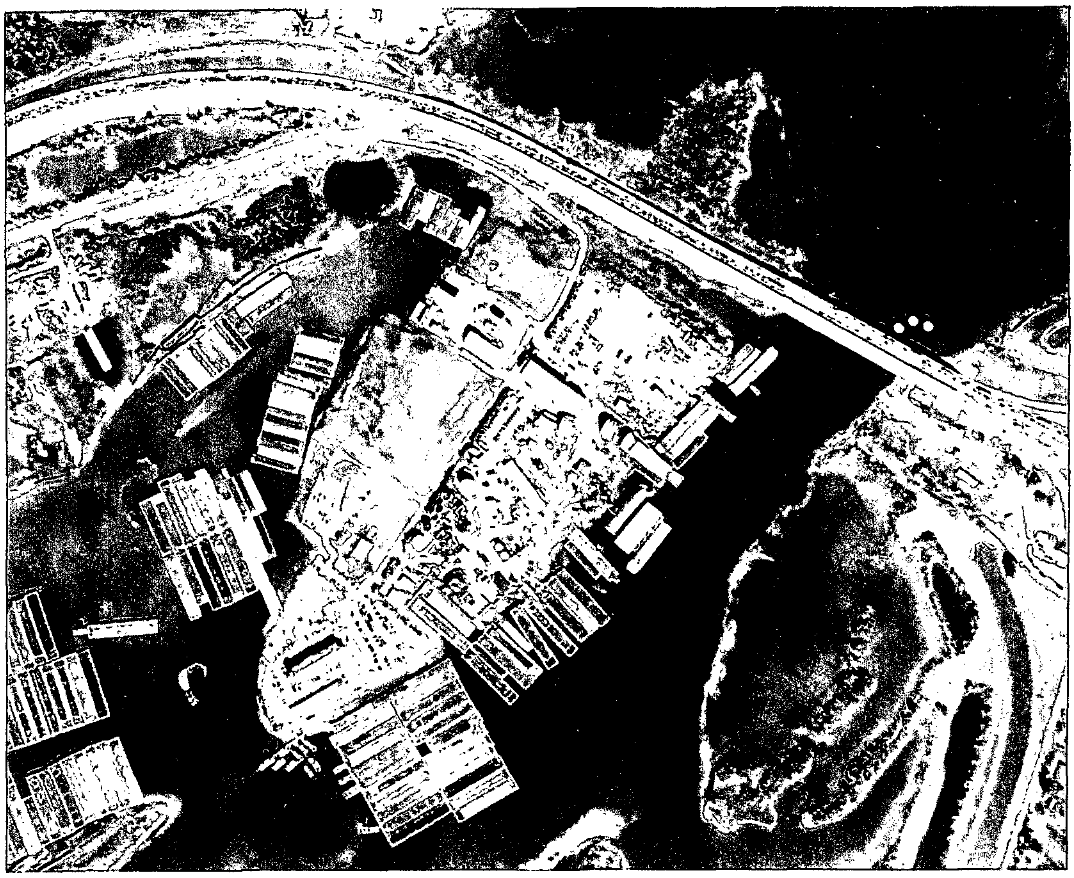
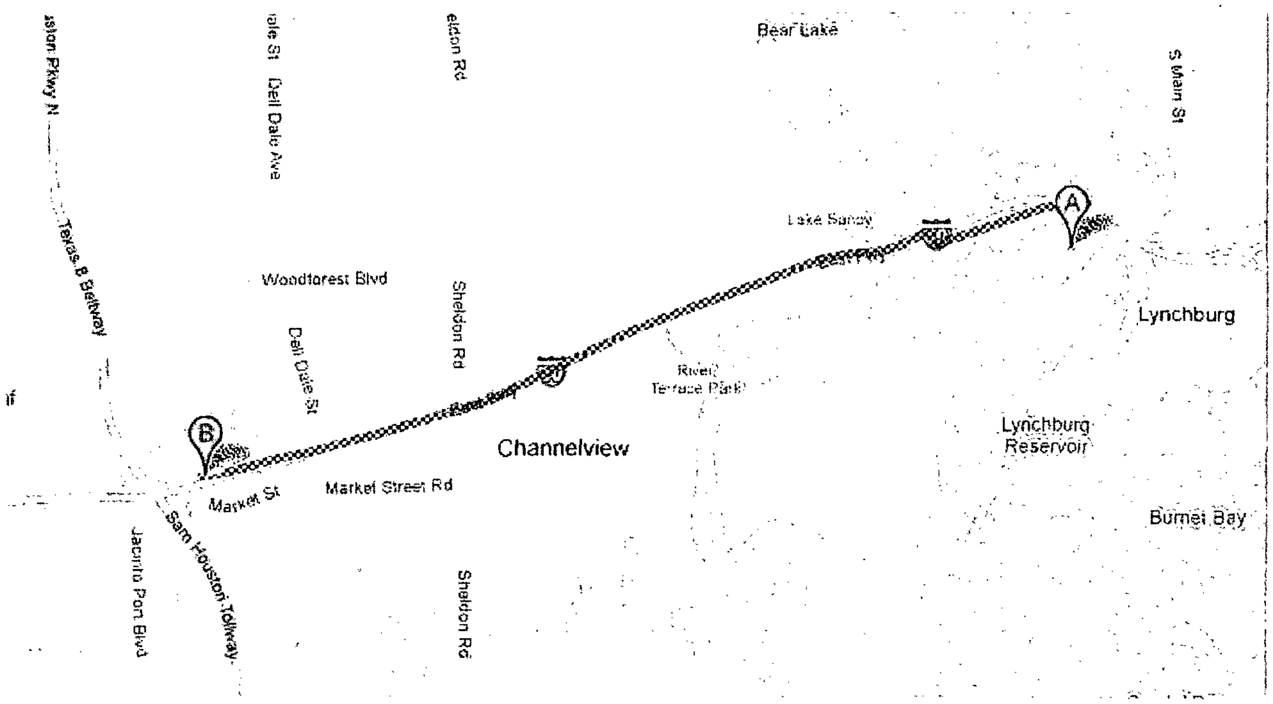


**Table B**

**Hospital Information**

| **Category** | **Information** |
|---|---|
| Hospital Name | Triumph Hospital – East Houston |
| Address | 15101 East Freeway |
| City, State | Channelview, TX 77530-41041 |
| Phone | (713) 691-6556 |
| Emergency Phone | (713) 691-6556 |

**Figure B**
**Hospital Route Map**

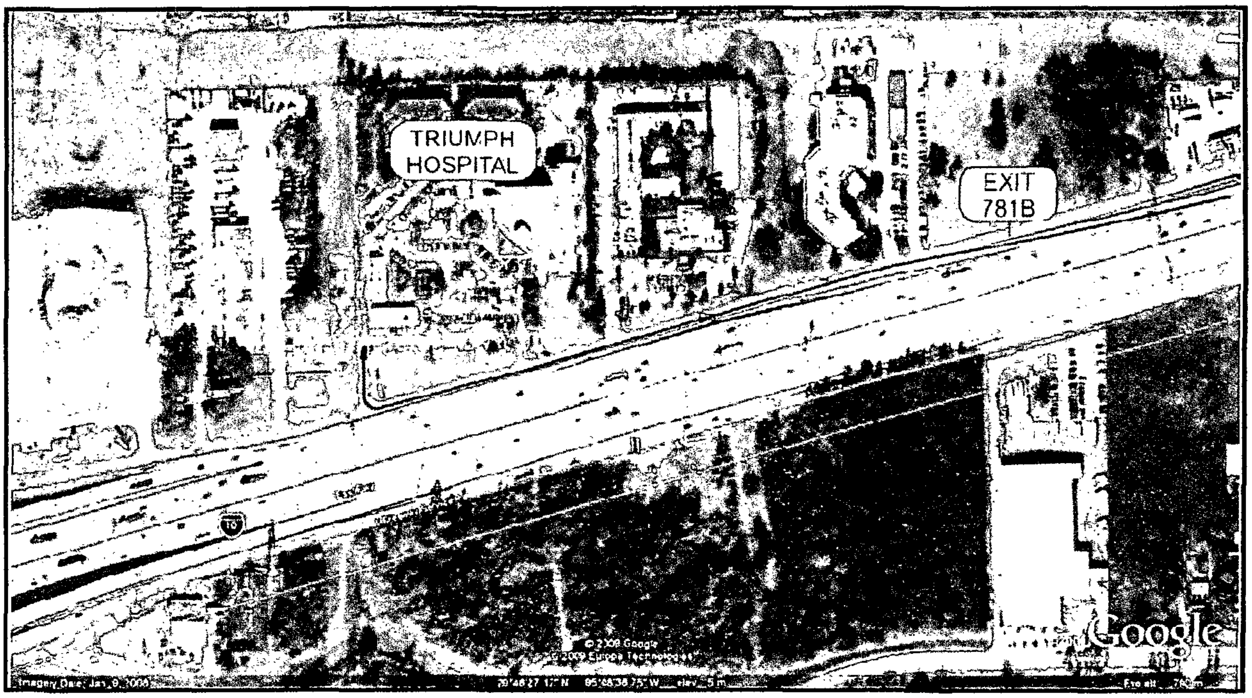



## DRIVING DIRECTIONS FROM SITE TO HOSPITAL

1. Head west on Market Street toward Market Street Road (approximately 1.1 mile).
2. Take the first right onto Monmouth Street.
3. Take the first left onto East Freeway Service Road.
4. Take the ramp on the left to I-10 West.
5. Proceed on I-10 West to Exit 781B (approximately 3.7 miles).
6. Exit freeway at Exit 781B onto East Freeway Service Road.
7. Continue heading west on East Freeway Service Road (approximately 0.2 mile).
8. Triumph Hospital will be on the right (total distance approximately 5 miles).

**Figure C**

**Hospital Detail (Egress from I-10 West)**



## Emergency Response Procedures

**In the event of an emergency, refer to the procedures in the San Jacinto River Waste Pits Superfund Site Overall HASP (Anchor QEA 2009).**

A copy of this Addendum must be included with the overall HASP, and both copies must be available in the field at all times during field work.

Other health and safety considerations for this sampling effort are addressed in Addendum 3 to the overall HASP, included as an attachment to the main Soil SAP. Additions to Section 2 detailing the area-specific scope of work are provided below.

## 2 SCOPE OF WORK

Soil samples will be collected from Area 4 (see Figure A-2 Field Sampling Plan [FSP] Addendum):

- Area 4. The upland area of the peninsula south of I-10.

The sampling design can be summarized as follows:

- **Area 4:** Two types of soil samples will be collected:
  - Surface and shallow subsurface soil sampling and analysis of chemicals of interest (COIs) at 4 locations from Area 4, in the uplands of the peninsula south of I-10 (stations SJTS032 through SJTS035; Figure A-2 of the FSP Addendum), to support evaluation of nature and extent of contamination, risk assessments, and development of the conceptual site model. Surface and subsurface soil samples will be collected at all 4 stations at depths of 0 to 6 inch (0 to 15 cm) and 6 to 12 inches (15 to 30 cm); all samples will be analyzed for COIs, total organic carbon (TOC), and grain size.
  - Soil cores at 7 locations from Area 4, in the western half of the peninsula south of I-10 (stations SJSB001 through SJSB007; Figure A-2 of the FSP Addendum), to support evaluation of nature and extent of contamination and development of the conceptual site model. Surface and subsurface soil samples will be collected at all core locations at depths of 0 to 6 inch (0 to 15 cm) and 6 to 12 inches (15 to 30 cm); a deep subsurface increment 12 to 24 inches (30 to 60 cm) will also be collected. The cores will be advanced until native fluvial deposits are reached (14-foot maximum) and every 2-foot interval will be sampled starting at 24 inches bgs to the maximum depth. All surface and subsurface samples will be analyzed for COIs, total organic carbon (TOC), and grain size.

The surface and subsurface soil samples will be collected using a stainless-steel shovel, trowel, spoon, hand auger, or hand corer. Soil borings will be installed using a truck-mounted AMS power probe™ or a similar sampling device (e.g., Geoprobe™).

# ATTACHMENT A3

# FIELD FORMS

integral consulting inc.
411 1st Avenue S, Suite 550
Seattle, WA 98104
(206) 230-9600 FAX (206) 230-9601

BORING ID ____
PROJECT ____
LOCATION ____
PROJECT NUMBER ____
LOGGED BY ____

North



| SAMPLE INFORMATION | | | | | | | | DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Photo No. | % Recov. | PID | FID | Sheen | Depth Feet | STRATA | USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc. | |
| | | | | | | 1-- | | | |
| | | | | | | 2-- | | | |
| | | | | | | 3-- | | | |
| | | | | | | 4-- | | | |
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| | | | | | | 14-- | | | |
| | | | | | | 15-- | | | |
| | | | | | | 16-- | | | |
| | | | | | | 17-- | | | |

DRILLING CONTRACTOR ____
DILLING METHOD ____
SAMPLING EQUIPMENT ____
DRILLING STARTED ____

COORDINATES ____
SURFACE ELEVATION ____
CASING ELEVATION ____
DATUM ____

# ATTACHMENT A4

# USEPA RISK ASSESSMENT GUIDANCE FORMS (PER THE UNILATERAL ADMINISTRATIVE ORDER STATEMENT OF WORK)

# EXHIBIT 5

# USEPA SAMPLING DESIGN SELECTION WORKSHEETS

## Exhibit 5. Part I: Medium Sampling Summary
### Sampling Design Selection Worksheet

**A. Site Name** San Jacinto River Waste Pits **B. Base Map Code** ____________

**C. Medium: Groundwater, Soil, Sediment, Surface Water, Air or Other (specify)** Soil

**D. Comments** Only the 3 surface intervals associated with the soil cores are included on this form, because the final achievable depth and total number of samples is currently unknown. These soil cores will be analyzed for COIs, TOC, and grain size.

| E. Medium/ Pathway Code | Exposure Pathway/ Exposure Area Name | F. Number of Samples from Part II | | | | | |
|---|---|---|---|---|---|---|---|
| | | Judgmental/ Purposive | Background | Statistical Design | Geometrical or Geostatistical Design | QC | Row Total |
| Soil | Nature and extent, exposure assessments, contaminant fate and transport | 29 | NA | NA | NA | 10 | 39 |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | **Column Totals:** | 29 | NA | NA | NA | 10 | 39 |
| | | | | | | **G. Grand Total:** | 39 |

## Exhibit 5. Part II: Exposure Pathway Summary

### Sampling Design Selection Worksheet (cont'd.)

| H. Radionuclide of Potential Concern and CAS Number | I. Frequency of Occurrence | J. Estimation | | K. CV | L. Background |
|---|---|---|---|---|---|
| | | Arithmetic Mean | Maximum | | |
| NA | NA | NA | NA | NA | NA |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**M. Code (CAS Number) of Radionuclide of Potential Concern Selected as Proxy** NA

**N. Reason for Defining New Stratum or Domain (check one)**

- ☐ Heterogeneous Radionuclide Distribution
- ☐ Geological Stratum Controls
- ☐ Historical Information Indicates Difference
- ☐ Field Screening Indicates Difference
- ☐ Exposure Variations
- ☒ Other (specify) NA

| Q. Stratum or Exposure Area | P. Reason | Q. Number of Samples from Part III | | | | | |
|---|---|---|---|---|---|---|---|
| Name and Code | | Judgmental/ Purposive | Background | Statistical Design | Geometrical or Geostatistical Design | QC | Row Total |
| Soil | Nature and extent, exposure assessments, contaminant fate and transport | 29 | NA | NA | NA | 10 | 39 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | R. Total (Part I, Step F): | NA | NA | NA | 10 | 39 |

## Exhibit 5. Part III: Exposure Area Summary
### Sampling Design Selection Worksheet (cont'd.)

**O. Stratum or Exposure Area** San Jacinto River Waste Pits **Domain Code** ______

**E. Medium/Pathway Code** Soil **Pathway Code** ______

**S. Judgmental or Purposive Sampling**

**Comments** ______

Use prior site information to place samples, or determine location and extent of contamination. Judgmental or purposive samples generally cannot be used to replace statistically located samples. An exposure area and stratum MUST be sampled by at least TWO samples.

**Number of Samples** 39

**T. Background Samples**

Background samples must be taken for each medium relevant to each stratum/area. Zero background samples are not acceptable. See the discussion on pp. 74-75 of Guidance for Data Useability in Risk Assessment Part A.

**Number of Background Samples** NA

**U. Statistical Samples**

CV of proxy or radionuclide of potential concern NA

Minimum Detectable Relative Difference (MDRD) NA (<40% if no other information exists)

Confidence Level NA (>80%) Power of Test NA (>90%)

**Number of Samples** (See formula in Appendix IV) NA

**V. Geometrical Samples**

Hot spot radius NA Enter distance units) NA

Probability of hot spot prior to investigation NA (0 to 100%)

Probability that NO hot spot exists after investigation (See formula in Appendix IV) NA (enter only if >75%)

**W. Geostatistical Samples**

Required number of samples to complete grid + number of short range samples NA

**X. Quality Control samples**

Number of Duplicates (Minimum 1:20 environmental samples) 5

Number of Blanks (Minimum 1 per medium per day or 1 per sampling process, whichever is greater) 5

**Y. Sample Total for Stratum** (Part II, Step U) ______

| Judgmental/ Purposive | Background | Statistical Design | Geometrical or Geostatistical Design | QC | Row Total |
|---|---|---|---|---|---|
| 29 | NA | NA | NA | 10 | 39 |

EXHIBIT 52

METHOD SELECTION WORKSHEET

## Exhibit 52. Method Selection Worksheet

| I. Analytes | | II. Medium | III. Critical parameters | | | | IV. Routine Available Methods[4] |
|---|---|---|---|---|---|---|---|
| A. Chemical or Class of Chemicals of Potential Concern | B. Reporting Requirement[1] (Y/N) | | A. Turnaround Time (enter hours or days) | B. ID Only or ID Plus Quant (ID or ID+Q) | C. Concentration of Concern (or PRG)[2] | D. Required Method Detection Limit[3] | |
| Dioxins/furans | N | Soil | 21 days | ID+Q | 2,3,7,8-TCDD TEQ of 17 ng/kg | Not applicable | 1613B |
| Aluminum | N | Soil | 21 days | ID+Q | 990,000 mg/kg | 198,000 mg/kg | 6010B / 6020 |
| Antimony | N | Soil | 21 days | ID+Q | 410 mg/kg | 82 mg/kg | 6010B / 6020 |
| Arsenic | N | Soil | 21 days | ID+Q | 1.6 mg/kg | 0.32 mg/kg | 6010B / 6020 |
| Barium | N | Soil | 21 days | ID+Q | 190,000 mg/kg | 38,000 mg/kg | 6010B / 6020 |
| Cadmium | N | Soil | 21 days | ID+Q | 800 mg/kg | 160 mg/kg | 6010B / 6020 |
| Chromium | N | Soil | 21 days | ID+Q | 1,500,000 mg/kg | 300,000 mg/kg | 6010B / 6020 |
| Cobalt | N | Soil | 21 days | ID+Q | 300 mg/kg | 60 mg/kg | 6010B / 6020 |
| Copper | N | Soil | 21 days | ID+Q | 41,000 mg/kg | 8,200 mg/kg | 6010B / 6020 |
| Lead | N | Soil | 21 days | ID+Q | 800 mg/kg | 160 mg/kg | 6010B / 6020 |
| Magnesium | N | Soil | 21 days | ID+Q | No value | Not applicable | 6010B / 6020 |
| Manganese | N | Soil | 21 days | ID+Q | 23,000 mg/kg | 4,600 mg/kg | 6010B / 6020 |
| Nickel | N | Soil | 21 days | ID+Q | 20,000 mg/kg | 4,000 mg/kg | 6010B / 6020 |
| Silver | N | Soil | 21 days | ID+Q | 5,100mg/kg | 1020 mg/kg | 6010B / 6020 |
| Thallium | N | Soil | 21 days | ID+Q | 78 mg/kg | 15.6 mg/kg | 6010B / 6020 |
| Vanadium | N | Soil | 21 days | ID+Q | 72 mg/kg | 14.4 mg/kg | 6010B / 6020 |
| Zinc | N | Soil | 21 days | ID+Q | 310,000 mg/kg | 62,000 mg/kg | 6010B / 6020 |
| Mercury | N | Soil | 21 days | ID+Q | 34 mg/kg | 6.8 mg/kg | 7471A |
| PCB 77 | N | Soil | 21 days | ID+Q | 110 μg/kg | 22 μg/kg | 1668A |

| I. Analytes | | II. Medium | III. Critical parameters | | | | IV. Routine Available Methods[4] |
|---|---|---|---|---|---|---|---|
| A. Chemical or Class of Chemicals of Potential Concern | B. Reporting Requirement[1] (Y/N) | | A. Turnaround Time (enter hours or days) | B. ID Only or ID Plus Quant (ID or ID+Q) | C. Concentration of Concern (or PRG)[2] | D. Required Method Detection Limit[3] | |
| PCB 81 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| PCB 105 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| PCB 114 | N | Soil | 21 days | ID+Q | 2.3 µg/kg | 0.46 µg/kg | 1668A |
| PCB 118 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| PCB 123 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| PCB 126 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| PCB 156 | N | Soil | 21 days | ID+Q | 230 µg/kg | 46 µg/kg | 1668A |
| PCB 157 | N | Soil | 21 days | ID+Q | 230 µg/kg | 46 µg/kg | 1668A |
| PCB 167 | N | Soil | 21 days | ID+Q | 1,100 µg/kg | 220 µg/kg | 1668A |
| PCB 169 | N | Soil | 21 days | ID+Q | 1.1 µg/kg | 0.22 µg/kg | 1668A |
| PCB 189 | N | Soil | 21 days | ID+Q | 110 µg/kg | 22 µg/kg | 1668A |
| Total PCBs | N | Soil | 21 days | ID+Q | No value | Not applicable | 1668A |
| Acenaphthene | N | Soil | 21 days | ID+Q | 33,000,000 µg/kg | 6,600,000µg/kg | 8270C |
| Fluorene | N | Soil | 21 days | ID+Q | 22,000,000 µg/kg | 4,400,000µg/kg | 8270C |
| Naphthalene | N | Soil | 21 days | ID+Q | 18,000 µg/kg | 3,600 µg/kg | 8270C |
| Phenanthrene | N | Soil | 21 days | ID+Q | 19,000,000 µg/kg | 3,800,000 µg/kg | 8270C |
| 2,4,6-Trichlorophenol | N | Soil | 21 days | ID+Q | 160,000 µg/kg | 32,000 µg/kg | 8270C |
| 2,4-Dichlorophenol | N | Soil | 21 days | ID+Q | 180,000 µg/kg | 36,000 µg/kg | 8270C |
| Pentachlorophenol | N | Soil | 21 days | ID+Q | 9,000 µg/kg | 1,800 µg/kg | 8270C |
| Phenol | N | Soil | 21 days | ID+Q | 180,000,000 µg/kg | 36,000,000 µg/kg | 8270C |
| Hexachlorobenzene | N | Soil | 21 days | ID+Q | 1,100 µg/kg | 220 µg/kg | 8270C |
| 2,3,4,6-Tetrachlorophenol | N | Soil | 21 days | ID+Q | 18,000,000 µg/kg | 3,600,000 µg/kg | 8270C |

| I. Analytes | | II. Medium | III. Critical parameters | | | | IV. Routine Available Methods[4] |
|---|---|---|---|---|---|---|---|
| A. Chemical or Class of Chemicals of Potential Concern | B. Reporting Requirement[1] (Y/N) | | A. Turnaround Time (enter hours or days) | B. ID Only or ID Plus Quant (ID or ID+Q) | C. Concentration of Concern (or PRG)[2] | D. Required Method Detection Limit[3] | |
| Carbazole | N | Soil | 21 days | ID+Q | 950,000 µg/kg | 190,000 µg/kg | 8270C |
| 2,4,5-Trichlorophenol | N | Soil | 21 days | ID+Q | 62,000,000 µg/kg | 12,400,000 µg/kg | 8270C |
| Bis(2-ethylhexyl) phthalate | N | Soil | 21 days | ID+Q | 120,000 µg/kg | 24,000 µg/kg | 8270C |
| Chloroform | N | Soil | 21 days | ID+Q | 1,500 µg/kg | 300 µg/kg | 8260B |
| 1,2,4-Trichlorobenzene | N | Soil | 21 days | ID+Q | 270,000 µg/kg | 54,000 µg/kg | 8260B |
| 1,2-Dichlorobenzene | N | Soil | 21 days | ID+Q | 9,800,000 µg/kg | 1,960,000 µg/kg | 8260B |
| 1,3-Dichlorobenzene | N | Soil | 21 days | ID+Q | 88,000 µg/kg | 17,600 µg/kg | 8260B |
| 1,4-Dichlorobenzene | N | Soil | 21 days | ID+Q | 12,000 µg/kg | 2,400 µg/kg | 8260B |
| 1,2,3-Trichlorobenzene | N | Soil | 21 days | ID+Q | 490,000 µg/kg | 98,000 µg/kg | 8260B |

[1]Y = total reported for compound class
N = each analyte reported separately
[2]Preliminary remediation goal
[3]Method detection limit should b no greater than 20% of concentration of concern
[4]Refer to Appendix III for specific methods. Recommend consultation with chemist and/or automated methods search to determine all methods available. (Exhibit 53 lists computer systems that support method selection.

# APPENDIX B
# AREA 4 HISTORICAL DOCUMENTS, HISTORICAL AERIAL IMAGES, AND LIDAR DATA
# SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

GDMS # 862018
pages 148-150

# McGinnes Industrial Maintenance Corporation

WPCB

201 NORTH RICHEY • PASADENA, TEXAS 77502 • GR 2-8587

JUL 1966 WATER POLLUTION CONTROL

July 21, 1966

Texas Water Pollution Control Board
1100 West 49th Street
Austin, Texas 78756

Attn: Mr. Hugh C. Yantis, Assistant Executive Secretary

Gentlemen:

In line with our recent discussion, permission is hereby requested for the release of a combination of stabilized waste water and rain water accumulated in a holding pond adjacent to Old River and Interstate Highway 10.

Attached is a tabulation showing the characteristics of the water to be released and a map giving the location of the pond.

The owner of the property has requested the early return of this facility for his own use and we need to take advantage of the hot summer months for maximum drying of the contents.

Your early consideration of this request will be appreciated.

Yours very truly,

McGINNES INDUSTRIAL MAINTENANCE CORP.

V. C. McGinnes

V. C. McGINNES
Vice-President

VCM:bgt
Enclosures

CHARACTERISTICS OF WASTE WATER

ORIGINAL DISPOSAL SITE

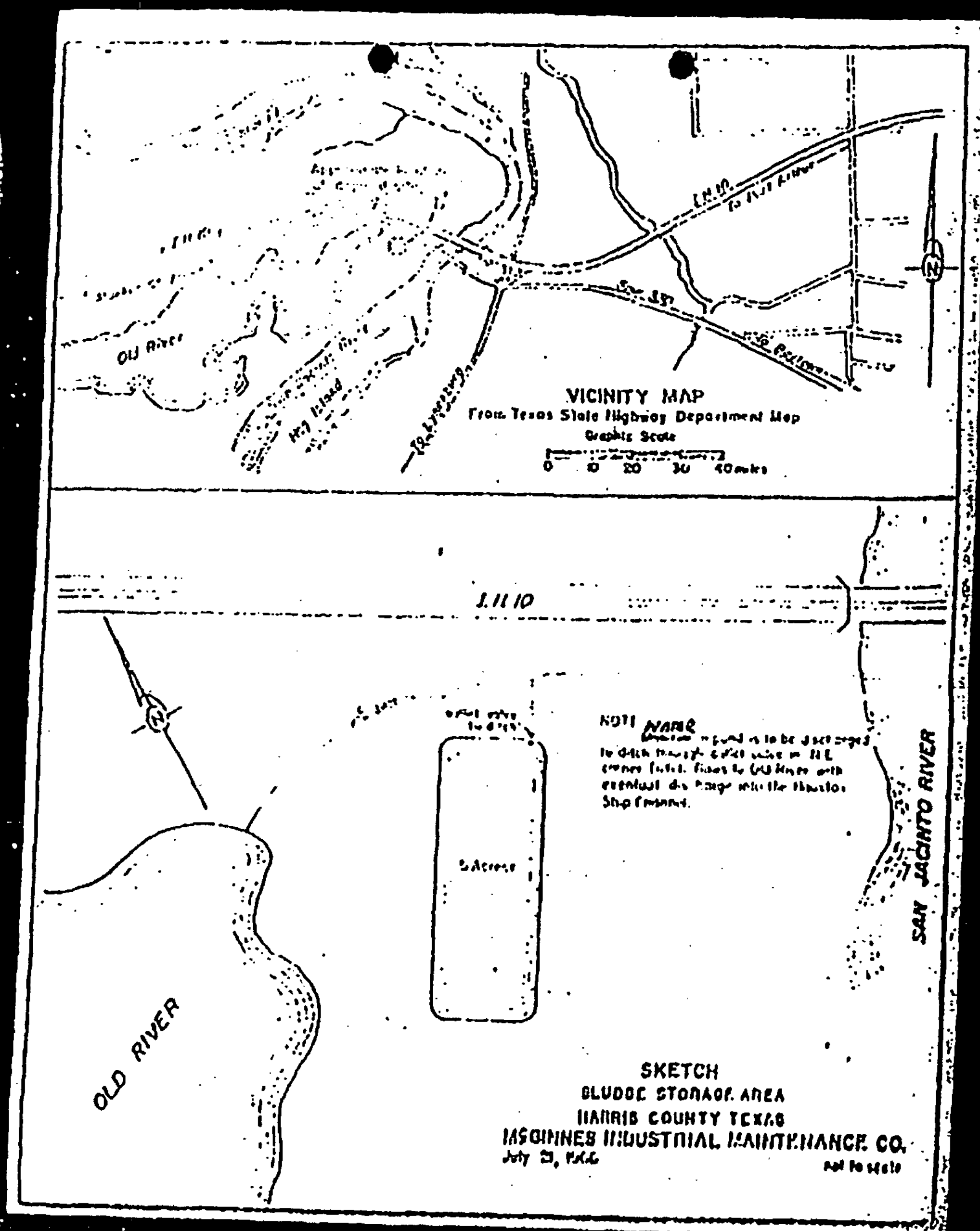
South of Highway 10

| Characteristic | 12-29-65 | 4-22-66 | State Test 4-22-66 | 5-25-66 | 6-29-66 | Zone 3 Objectives |
|---|---|---|---|---|---|---|
| pH | 7.9 | 5.2 | 5.3 | 7.7 | 7.3 | 6.5 - 10.5 |
| BOD, ppm | 79 | < 14 | 8 | 35 | 13 | 50 |
| Chloride, ppm | 1056 | 2070 | 2050 | 1664 | 1935 | - |
| Alkalinity, ppm | 403 | - | - | - | 525 | - |
| Dissolved Oxygen, ppm | 0.4 | 7.8 | 2.2* | 0.3 | 6.3 | - |
| Total Suspended Solids, ppm | 114 | 36 | 20 | 140 | 50 | 165 |
| Volatile Suspended Solids, ppm | - | 30 | 13 | - | 44 | 52 |
| Dissolved Solids, ppm | - | 4224 | 4371 | 3364 | 4232 | - |
| Sulfate, ppm | - | 54 | 50 | 43 | 43 | - |
| COD, ppm | - | 196 | - | - | 283 | 320 |
| Color, ppm | - | 65 | 110 | 138 | 150 | - |
| Temperature, °F | | | | | 94 | |

Disposal operations terminated at this location about September 14, 1965.

*Sample not fixed in field at time of collection.

MIMC – 000108


VICINITY MAP
From Texas State Highway Department Map
Graphic Scale
0 10 20 30 40 miles
Old River
I.H.10
J.H.10
OLD RIVER
SAN JACINTO RIVER
SKETCH
SLUDGE STORAGE AREA
HARRIS COUNTY TEXAS
McGINNES INDUSTRIAL MAINTENANCE CO.
not to scale

SDMS 1186018
Pages 172-174

# STATE DEPARTMENT OF HEALTH

AUSTIN TEXAS

INTER-OFFICE

FROM: Stanley W. Thompson, P.E., Regional Engineer

TO: H.F. Smithhorst, P.E., Director, Division of Water Pollution Control

SUBJECT: Investigation of Industrial Waste Disposal - Champion Paper, Inc., Pasadena

Following a request from Hugh Yantis, Assistant Executive Secretary of the Water Pollution Control Board, the writer and Sanitarian John Kidd contacted officials of the Champion Paper, Inc., Pasadena, Texas, and made an investigation of the present waste disposal practices of the company. This investigation was made on April 22, 1966.

Persons contacted during the course of the investigation included:

| | | |
|---|---|---|
| Mr. J.L. Henderson | - Champion Paper | |
| Mr. A.J. Navarre | - " " | |
| Mr. V.C. McGinnes | - McGinnes Industrial Maint. Corp. | |
| Mr. George Lowrie | - " " " " | (Secry-Treas) |
| A.E. Kimball | - " " " " | (Gen. Manager) |

The mailing addresses of the company are:

Champion Papers, Inc., P.O. Box 872, Pasadena, Texas 77501

McGinnes Ind. Maint. Corp., 201 N. Richey, Pasadena, Tex 77502

In addition to the above, Sanitarian Bob Douglass of the Harris County Health Department, Air and Stream Pollution Section, was contacted in the absence of Dr. W.A. Quebedeaux, Chief of the Section. Mr. Douglass was unable to assist in the inspection.

General

The investigation covered the present practice of disposal of settled solids from the Champion Paper processes, a practice which is carried out by the McGinnes Ind. Maint. Corp. This practice consists of the removal of the settled material from the secondary ponds at Champion plant, the transporting of the material by barge to an area adjacent to the San Jacinto River (near Hwy 73), and the unloading from the barge into ponds which have been formed by levees. This operation has been carried out since [illegible] with the first operation in June of 1965. This work was done by the Ollie Peterson Construction Co., with the McGinnes Corp. taking over and beginning operation on September 13, 1965.

This particular type of operation is carried out in a cycle of sorts. The ponds at Champion are allowed to fill with the material (or one full and the other approaching it) and hauling is then begun on the full pit. At the time of the inspection, both pits had been cleaned with about 5 barge loads (est. by Mr. McGinnes) left to remove. This would complete the operation until the ponds are again full - which is expected to be sometime later this year.

SIGNED____________________

MIMC – 000101

## Quality of Material Removed

An analysis of the material was not available, but officials of Champion indicated that the material was neutral in pH, non-toxic, and primarily fibrous. The dried material resembled a cheaper grade of cardboard - such as used in egg cartons, etc. Mr. McGinnes reported that he had used it successfully for matting for his equipment in the disposal site.

The material appears to solidify rapidly and Mr. Henderson reported that a vertical wall can be cut in the ponds while removing it and that the wall will stand. It was also reported that after the material has set a short time, that water will not penetrate it - that rain water will stand over it. It was further reported that grass can be started on the dry material and that it will spread rapidly, thus further cutting off water.

The material is removed by use of jetting (using waste water from the third set of ponds) and is reported to be removed with a solid content of 25% to 30%.

## Quantity of Material

It was estimated by Mr. Henderson that complete cleaning of the two ponds would result in removal of about 135,000 cubic yards of the material. The barges used in the operation will hold about 1000 yards and three barges are used. This allows one barge to be in the process of being filled, one to be in the process of being unloaded, and one to be in transit. About 6 hours is required for for the complete operation. Two shifts have been in operation to allow an average of 6 barge loads per day to be hauled.

Mr. Henderson stated that the material was accumulating at Champion at an estimated rate of 1 barge load per day.

## Disposal Site

As mentioned, the disposal site is adjacent to the San Jacinto River at the Hwy 73 Bridge with the older site on the south side of the Highway and the newer site on the North side. The older site was used prior to McGinnes Corp taking over the operation and appears to consist of a pond covering between 15 and 20 acres. The new (and present) site consists of an estimated 20+ acres, of which slightly less than 15 are being used. This area contains two ponds.

One of the ponds has been filled and the second is nearly full. Levees on the first pond appear to be in good shape, with possibly slight seepage, while the second pond needs additional work on the levees. According to Mr. McGinnes, wet weather has prohibited the proper completion of the levees and additional work is to be done as soon as possible.

The two new ponds are connected with a drain line to allow the flow of excess water (including rain water) from pond #1 to pond #2, where it collects near the barge unloading area. At the present time, this water is pumped back into the barges and returned to the Champion Paper plant where it is passed through the last settling ponds and discharged to the Channel with the rest of the plant effluent. This particular operation will be mentioned later in the report.

### Danger to River

According to available information, the river is not subject to flooding which might wash out the levees – that is, subject to flooding from rainfall without the aid of a storm such as Carla. In that event, the disposal area might well be covered with water.

It also appears that the material will solidify after being in the ponds a short time and there would be no danger of pollution from seepage. The only water is that which does separate from the solid material and rainfall.

### Excess Water & Its Disposal

At the present time, the excess water plus rainfall which collects in the pond area is pumped into the barges and is carried back to Champion Paper and discharged through the final settling ponds. According to Mr. Henderson and Mr. McGinnes, this operation is not economical and they are very interested in finding out if the water could be discharged into the River at the disposal site. The main thought in the removal of water being that the solidification of the material and the draining of the top water would allow the discharge of more wastes to the area.

An example of this is the older area (South of the Hwy), where the water ranges from 3 - 5 feet deep. Mr. Kimball had a minnow bucket type of container submerged in this water with fish in it and reported that they had been there for several weeks. These fish (or minnows) were in good condition.

### Quality of Excess Water

Samples were collected of the water in the various pits and submitted to the Austin State Dept of Health Laboratory for analysis. The samples and their results are as follows:

| Point of coll | pH | BOD | Sulphates | Chlorides | S.S | D.O. | Col |
|---|---|---|---|---|---|---|---|
| #1 - New Pond #2 - near pt of return to barge | 7.8 | 1590 | 5 | 790 | 213 | 0 | 220 |
| #2 - New Pond #1 | 7.4 | > 2,500 | 31 | 470 | 324 | 0 | 110 |
| #3 - San Jacinto River - near barging pt | 7.3 | 2.5 | 78 | 465 | 36 | 4.4 | |
| #4 - Old Pond - South of Hwy 73 | 8.3 | 8.0 | 50 | 2060 | 70 | 2.2 | 110 |

In general appearance, samples #1 and #2 were very dark with #4 somewhat lighter. The water from the older pond (Sample #4) had been undisturbed for some 6 to 7 months.

[illegible]

Officials of both companies were most anxious to work something out regarding this method of waste disposal. It appears that several things are to be considered in the matter.

1. The type of waste involved is not easy to get rid of, there is a large amount of the waste, and there will be an even larger amount in the future. This larger amount will be due to the new, and more efficient, waste treatment equipment that is to be provided by Champion Paper.

2. Very large tracts of land would be required for extended operation of this type, and this land would need to be accessible to barges - so on major rivers or streams. Apparently, the company officials feel that they can return to the areas after a period of time and deposit additional material. This would be necessary to get the full benefit from the land.

3. There is no market for such material for use as fill material.

4. It also appears that continued operation would depend on the ability to return the water off the ponds to the adjacent stream rather than return it to the plant.

The operation and the need for submitting an application for a permit from the WCB was discussed with Mr. Henderson and Mr. McGinnes, and it is understood that such a permit would be obtained by Mr. McGinnes rather than by Champion. There is apparently the thought, or plan, that Mr. McGinnes would obtain the permit and handle the wastes from Champion under contract (the present set-up) and then also take care of such other industrial wastes that he might be able to handle (not from Champion).

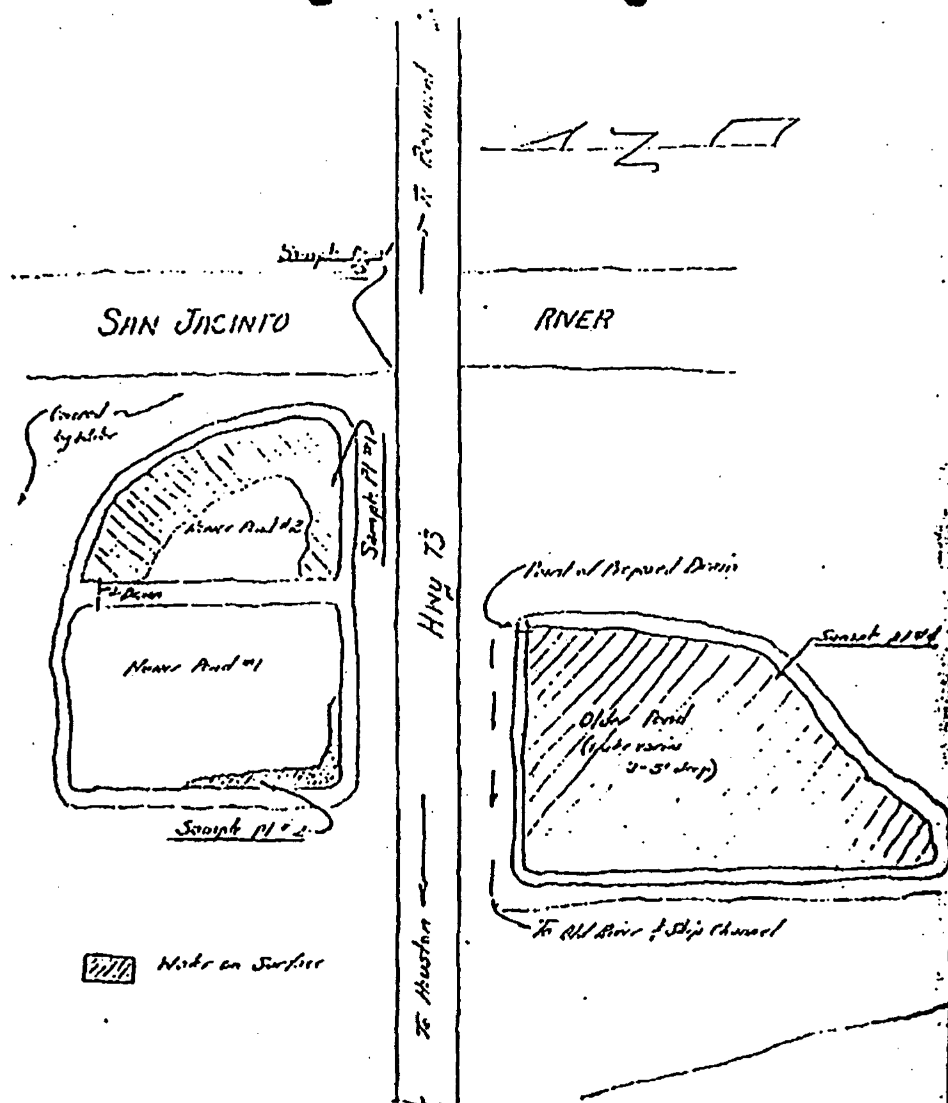
It is the writer's understanding that nothing was to be done in the way of a permit application until the results of the sample analyses were received. At that time, the company officials would get in touch with the WPCB and its staff to discuss the matter further and get the thinking of the Board in light of the sample results. By that time, the companies should also have information regarding the chemical content of the material. It was felt that this would be the best approach to the matter since the present cycle of operation was essentially completed and time would be available to either obtain a permit for the operation - or work out a different method of disposal- prior to the need for renewed removal of the waste material.

Respectfully submitted,

Stanley W. Thompson

Stanley W. Thompson, P.E.
May 6, 1966

MIMC - 000104




DISPOSAL AREA
WASTE FROM CHAMPION PAPER, INC

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ANCHOR QEA integral consulting inc.

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Feet

**Figure B-1**
1962 Aerial Photograph
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

**DRAFT**
DO NOT QUOTE OR CITE

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Feet

**Figure B-2**
1964 Aerial Photograph
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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**Figure B-3**
1966 Aerial Photograph
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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**Figure B-4**
1970 Aerial Photograph
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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**Figure B-5**
1973 Aerial Photograph
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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**Figure B-6**
1964 and 1973 Aerial Photographs
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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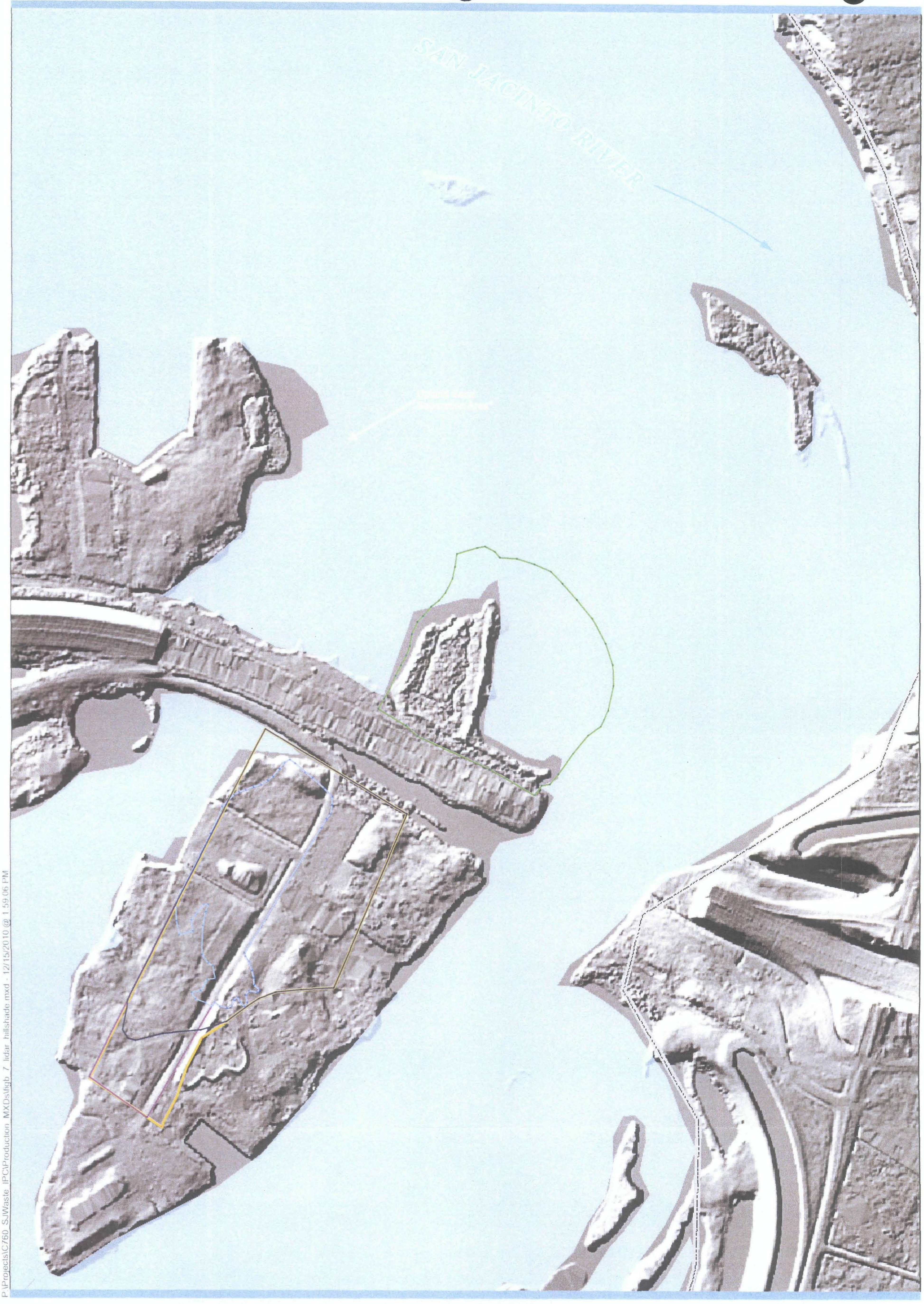


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integral consulting inc.

0 800
Scale in Feet

- Approximate impoundment boundary derived from historical TSDH drawings.
- Boundary of a flooded area that is visible in a 1966 aerial photograph
- The smaller of two approximate impoundment boundaries proposed by EPA on the basis of a 1964 aerial photograph.
- The larger of two approximate impoundment boundaries proposed by EPA on the basis of historical drawings by the TSDH.
- USEPA's Preliminary Site Perimeter
- Original (1966) Perimeter of the Northern Impoundments

* Designation of the sand separation area is intended to be a general reference to areas in which such activities are believed to have taken place based on visual observations of aerial photography from 1998 through 2002.

FEATURE SOURCES: Aerial Imagery: 0.5-meter. Photo Date: 01/14/2009 (StratMap) TNRIS.

**Figure B-7**
2008 LiDAR Hillshade
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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DO NOT QUOTE OR CITE

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**Figure B-8**
Google Earth Aerial Extracted 12-15-2010
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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DO NOT QUOTE OR CITE



ANCHOR QEA integral

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Feet

**Figure B-9**
1964 and 2010 Aerial Photographs
SJRWP Soil SAP Addendum 1
SJRWP Superfund/IPC

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